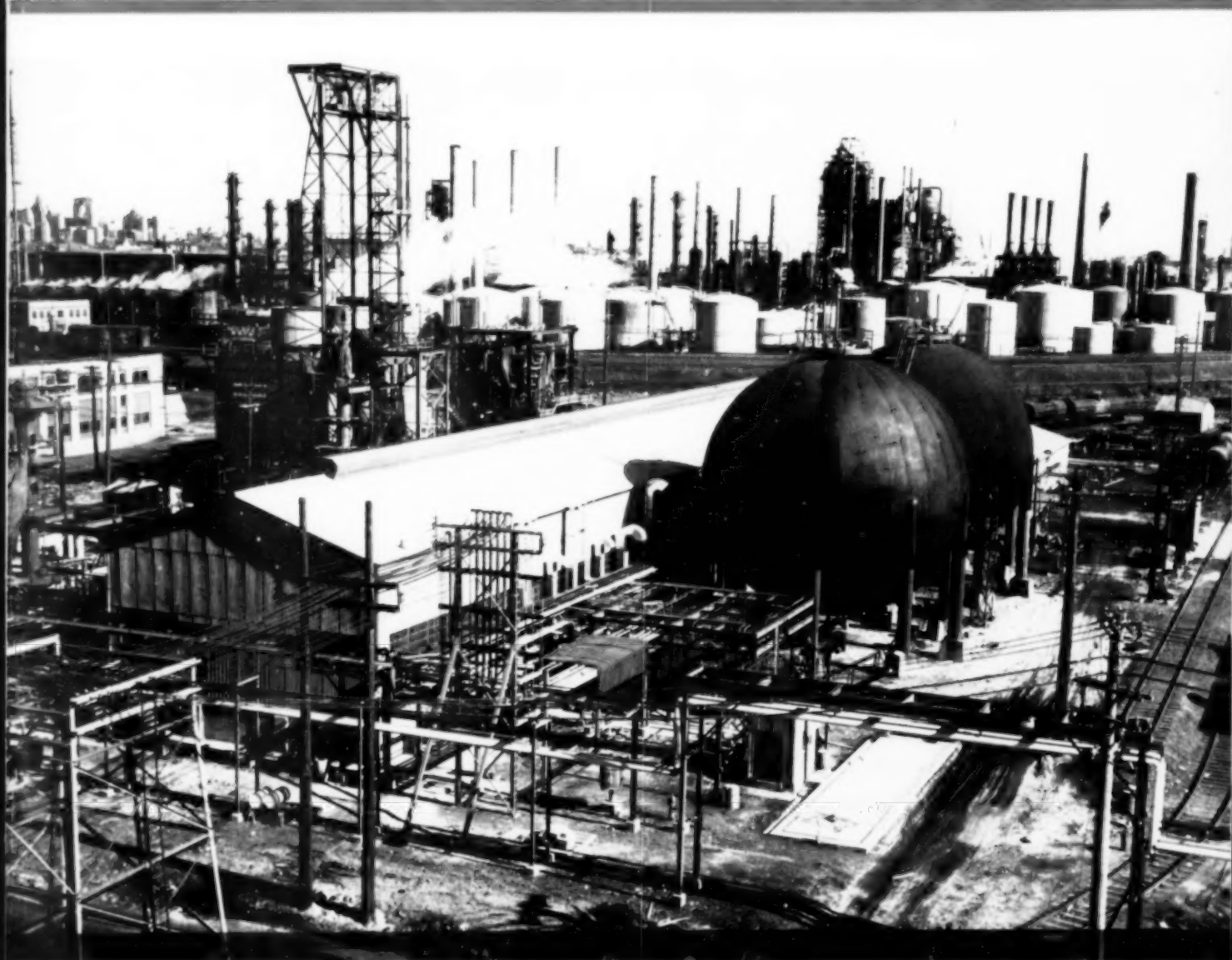


AGRICULTURAL CHEMICALS



In This Issue:

Soil Fumigation • NAC Convention Program • Fly Control on Livestock • Sulfur Story
Mississippi Ag. Station • Midwestern Agricultural Potential • Entomology Centennial • CFA



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New!**

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FLAKES**

(Patent applied for)



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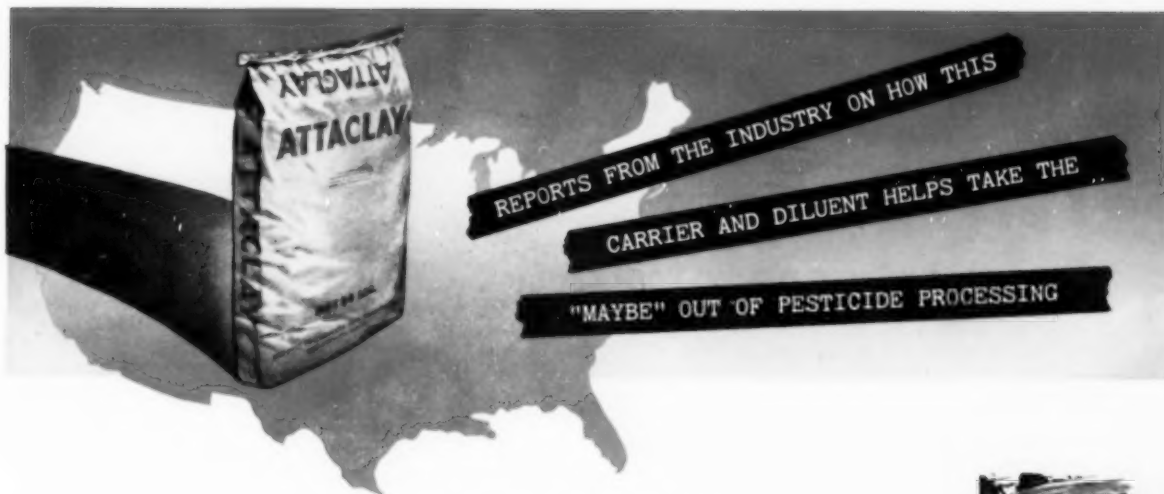
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over-all
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and
efficiency

LOCATION: Pacific Northwest

PLANT MANAGER: *We make many products, yet inventory only one carrier and diluent—Attacloy. It does so many jobs so well that advantages show up all along the line—from simplified procurement to better finished products.*



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a better start

in life



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Tobacco growers have learned that it pays to control weeds in tobacco plant beds with AERO CYANAMID, Granular. Better weed control and healthier plants, which grow off faster in the field after transplanting, save the grower time and labor . . . help him grow a more profitable crop.

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AGRICULTURAL CHEMICALS

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**A Monthly Magazine
For the Trade**

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This Month's Cover

Atlantic Refining Co.'s new anhydrous ammonia plant located at the Philadelphia refinery. The unit is designed to produce 100 tons of ammonia daily using by-product hydrogen from the company's catalytic reformer gas. See story on page 77.

AUGUST
Vol. 9

1954
No. 8

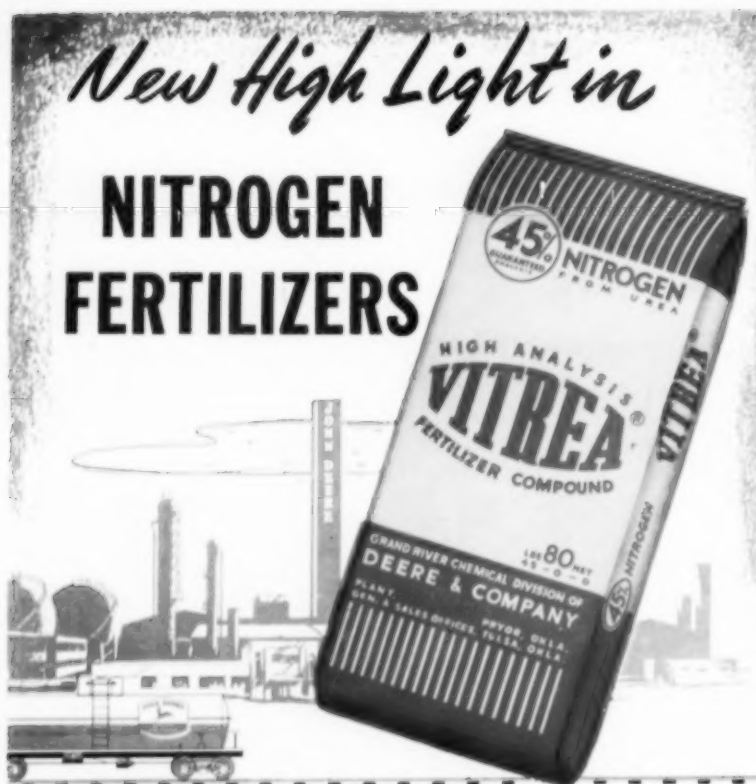
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Meeting Calendar

- Aug. 10-12 — Ohio Pesticide Institute summer tour, starting at Wooster, Ohio
- Aug. 11 — Annual Kentucky Fertilizer Conference, Guignol Theater, Univ. of Kentucky, Lexington.
- Aug. 17-21 — Rocky Mountain Conference of Entomologists, Fort Collins, Col.
- Aug. 18 — Conn. Agricultural Experiment Station Field Day.
- August 25-27 — American Phytopathological Society, 46th Annual Meeting, Estes Park, Colo.
- Aug. 30-Sept. 3 — National Shade Tree Conference, Haddon Hall Hotel, Atlantic City, N. J.
- Sept. 5 — National Joint Committee on Fertilizer Application and American Society for Horticultural Science, University of Florida, Gainesville.
- Sept. 8-10 — National Agricultural Chemicals Association, Spring Lake, N. J.
- Sept. 19-22 — Western States Garden Supply Show, Exposition Building, Oakland, Cal.
- Oct. 6-7 — Fifth Annual Convention, Pacific Northwest Plant Food Association, Sun Valley, Ida.
- Oct. 11-13 — Association of Official Agricultural Chemists, Inc., Shoreham Hotel, Washington, D. C.
- Oct. 13-14 — Association of American Feed Control Officials, Shoreham, Washington, D. C.
- Oct. 14-15 — Society of Agricultural Engineers, Pacific Northwest Section, Davenport Hotel, Spokane.
- Oct. 15 — Association of American Fertilizer Control Officials, Shoreham Hotel, Washington, D. C.
- Oct. 16 — Association of Economic Poison Control Officials, Shoreham Hotel, Washington, D. C.
- Oct. 18-19 — Fertilizer Section, NSC, Chicago, Ill.
- Oct. 26-27 — Annual Washington State College Dusting and Spraying Conference, Chinook Hotel, Yakima, Wash.
- Nov. 3-4 — South Carolina Annual Fertilizer Meeting, Clemson College, Clemson, S.C.
- Nov. 8-12 — American Society of Agronomy, St. Paul Hotel, St. Paul, Minn.
- Nov. 10-12 — National Fertilizer Assoc., Hollywood Beach Hotel, Hollywood, Fla.
- Nov. 15-16 — Eastern Branch, E.S.A., Hotel New Yorker, New York City.
- Nov. 15-16 — California Fertilizer Association, del Coronado Hotel, Coronado, Cal.
- Dec. 2-3 — Beltwide Cotton Insect Control Conference, Adolphus Hotel, Dallas, Tex.
- Dec. 5-8 — Agricultural Ammonia Institute, Jung Hotel, New Orleans.
- Dec. 6-9 — Entomological Society of America, annual meeting, Houston, Tex.

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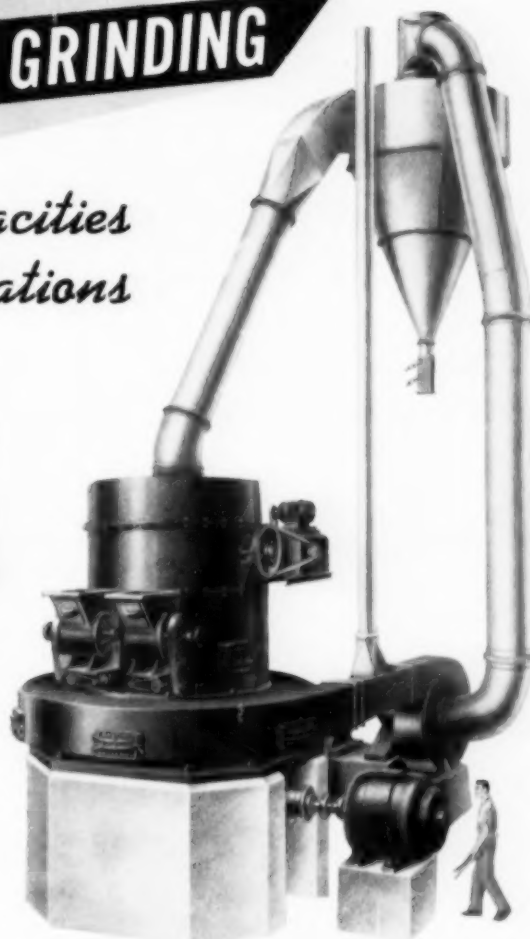
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... a compact unit for making field strength products and lower concentrate formulations.



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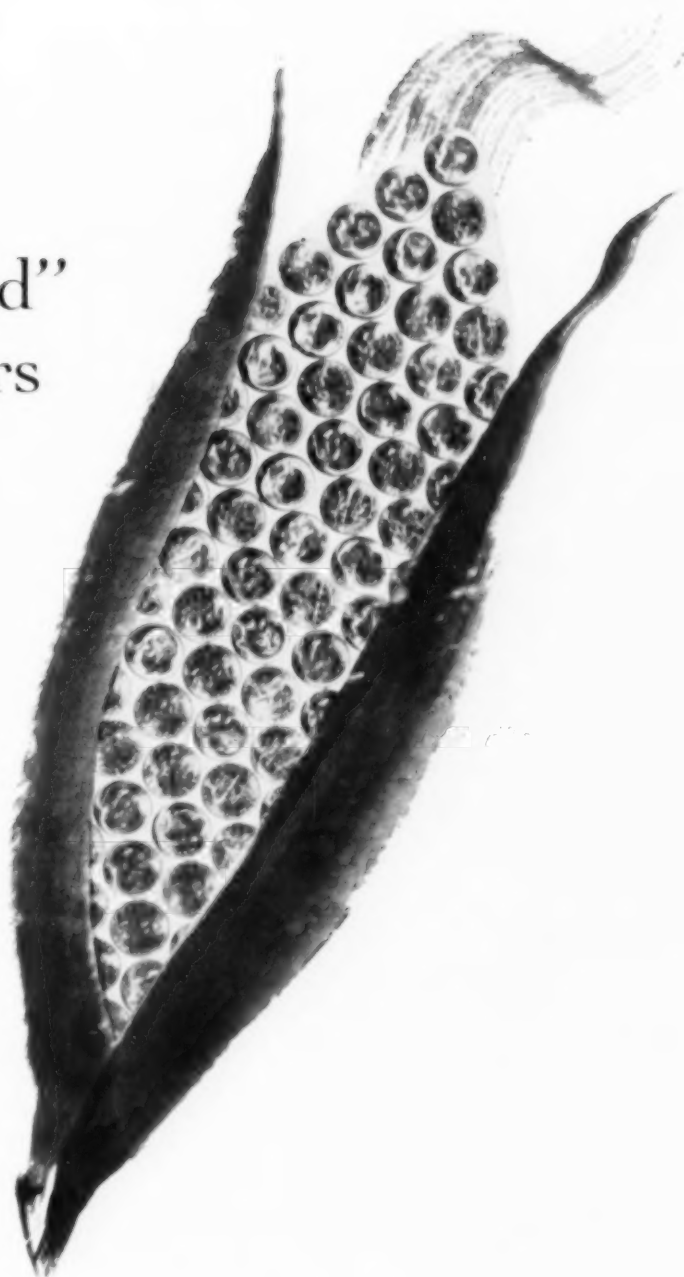
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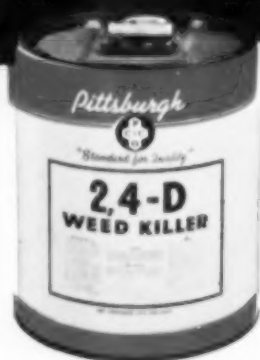
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WINDOW STREAMER: Pittsburgh 2,4-D WEED KILLER. Standard for Quality. For Mustard, Thistle And Lamb's Quarters.

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INFORMATIVE LITERATURE: Pittsburgh 2,4-D.




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ORGANIC PHOSPHATE INSECTICIDES: Parathion Wettable Powders, Parathion Liquid Concentrate, Systox.

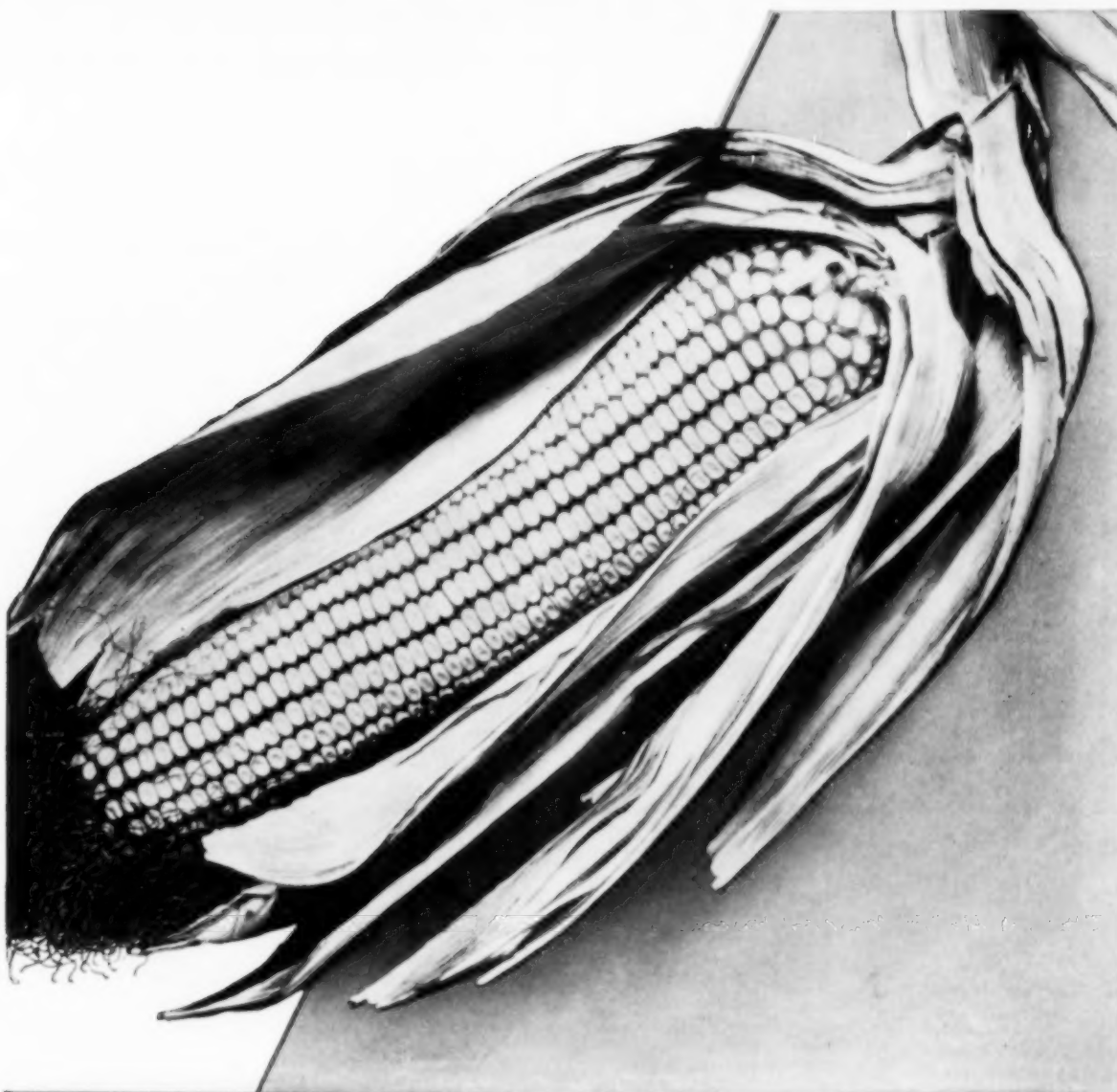
WEED KILLERS: 2,4-D Acid, 2,4-D Amine Concentrates, 2,4-D Ester Formulated Concentrates, D4 (Low Volatile 2,4-D Ester), C4 Pre-Emergence Weed Killer, 2,4,5-T Formulations.



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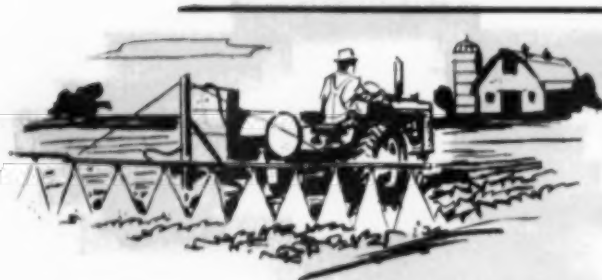
AUGUST, 1954

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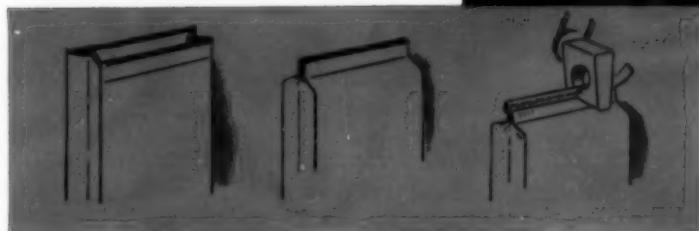
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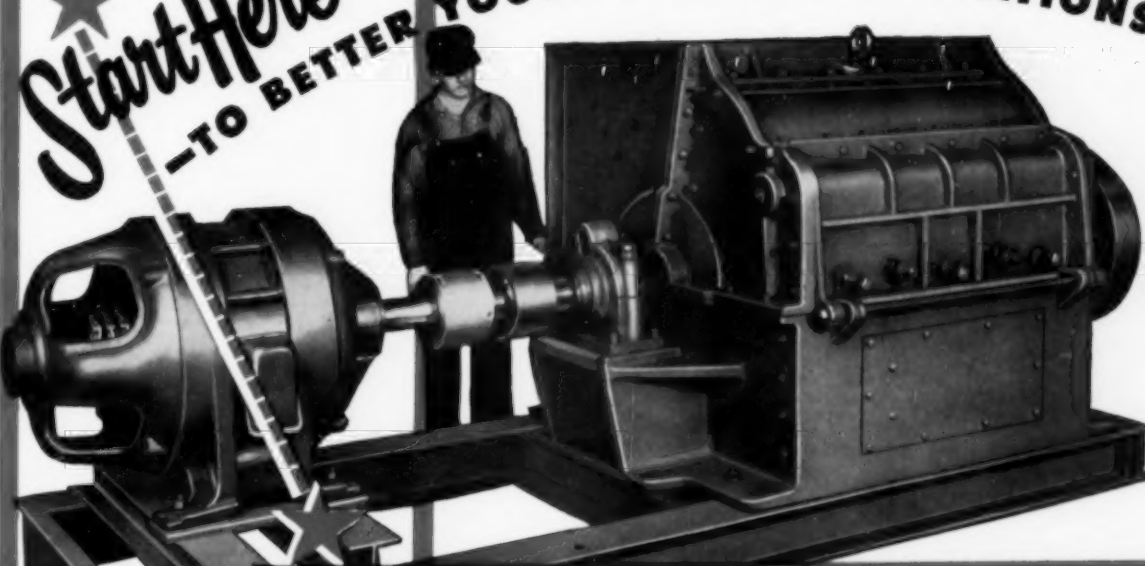
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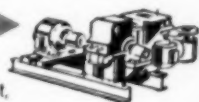


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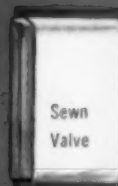
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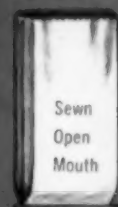
- 1 Responsibility
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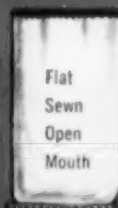
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Open
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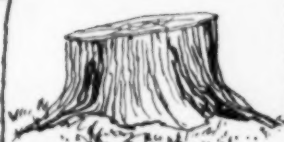
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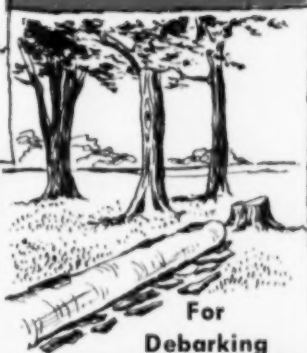
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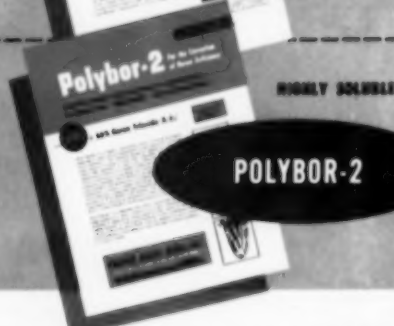
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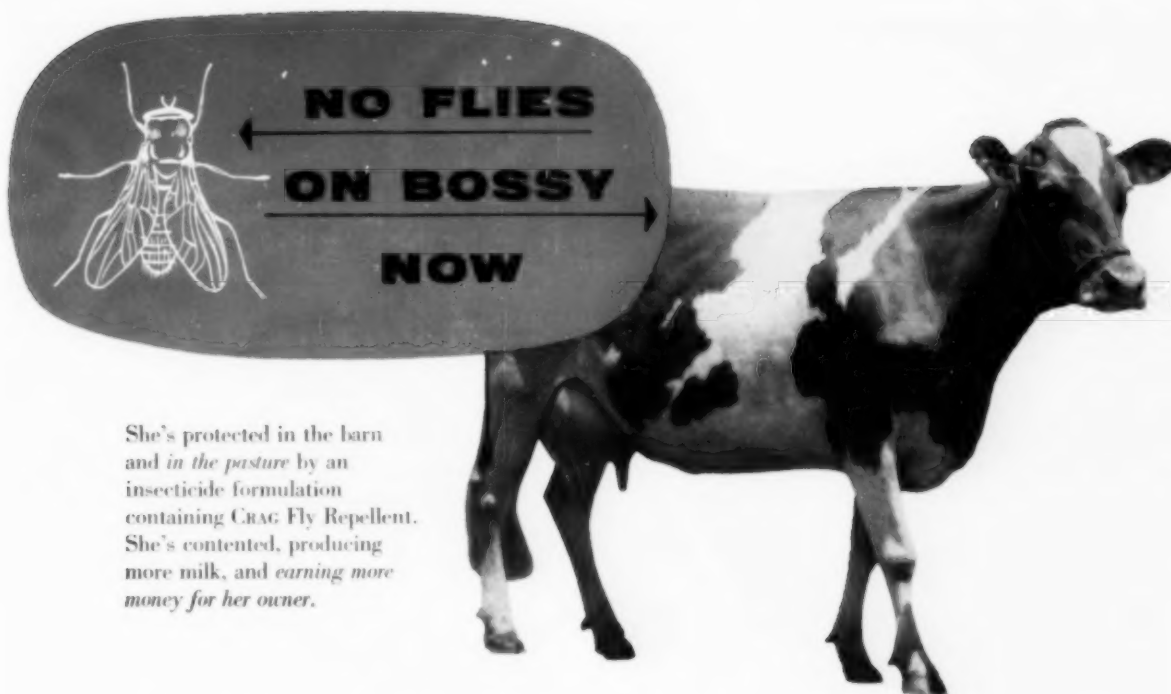
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Editorial COMMENTS

R EPORTS from the insecticide front line indicate that while business this season is not doing quite as well as some of the more optimistic had hoped earlier in the season that it might do, it is at least making the best record since '51. After the dismal years of '52 and '53 it seemed apparent that an upturn might well be expected, but with insecticide sales depending as heavily as they do on such unpredictables as weather, crops and infestations, it was not beyond the limits of chance that we might have had another very poor sales record this year. Fortunately, demand for insecticides has picked up substantially in many areas, sales have improved on many materials, and there have even been some profits, - very welcome after the two poor seasons.

Rain, through the parched southwest, was an important factor in the upturn, in that area, for cotton of recent years has bulked bigger and bigger as a factor in determining national insecticide consumption. Unfortunately drought has hit the southeast this season, and the picture is a dismal one in the Carolinas, Virginia and Georgia. The complete story is not yet in, of course, on the cotton market, and what is needed right at the moment is another inch or two of rain. If this materializes, insecticide sales in the cotton belt could still establish a satisfactory record for the season.

In the northeast, demand for pesticides by fruit growers has been heavy. Growers have seen what insecticide application can mean in the way of higher quality, better finish crops, that bring a premium in the market, and they have been buying and using substantially increased quantities of insecticides this season.

Other bright spots in the national picture are the midwest and the northwest. Demand for insecticides has been good from both areas, prices have held well, and the outlook continues good for the balance of the season.

As to the price and profit picture, we get widely conflicting reports, as perhaps might be normal in a market as spotty as this year's insecticide market has been. Early in the season producers were fairly firm about adhering to their schedules on the basic materials, BHC and DDT, but recently weakness has developed as unsold stocks sought markets. Without the government buying which has taken substantial quantities of material off the commercial market, the price situation might well have weakened much earlier, and the cuts have been more drastic.

As in all spotty markets, stocks in low-demand areas have been crying for buyers, while in areas where business is good we have even been hearing over recent weeks some of those old familiar cries of the disappointed salesman that used to bring tears to our eyes back in '50 and '51. Stories of how said salesman finally sold an account after three years of calling, - and now his plant is unable to make delivery short of six weeks. Stories of how people want prompt shipments, - and suppliers are being stuffy about credit. Stories of how a regular buyer ordered five drums of material early season, and now wants a quick car, and can't get it.

Such stories are music to our ears, as they must be to the ears of the few home offices that have been fortunate enough to hear them this season. They reflect problems, of course, - but the type problems of which the industry could use more, - this year and next.



PROGRESS in soil fumigation for the control of nematodes and other pests was last reviewed in *Agricultural Chemicals** about two years ago. At the time, an intensive campaign to promote the large scale use of dichloropropene-dichloropropane (D-D) and ethylene dibromide (EDB) had been in progress for several years and the use of these materials was rapidly increasing. Demand for the older soil fumigants, chloropicrin and methyl bromide, for fumigation of seedbeds and other small areas had also increased, and chlorobromopropene had recently been placed on the market for this purpose. The basic information necessary for the use of soil fumigants was available, and application procedures and applicator designs were being standardized.

In the past two years, sales of soil fumigants have increased beyond all expectation as more and more growers have become acquainted with their advantages. Thousands of acres of soil for tobacco, vegetables and other crops of high value have been fumigated for the first time. The principal change in formulations has been an increase of the active ingredient of ethylene dibromide fumigants to

83%, with a corresponding decrease in the application rate per acre. Basic design of applicators has not changed, though refinements have been made and the old "home-made" applicator has been replaced largely by a variety of commercial machines.

As the use of soil fumigants has expanded, it has become increasingly evident that control of soil pests is the key to the solution to a great number of problems in agriculture and the growing of ornamental plants. This development has already had many ramifications, and shows promise of eventually producing profound changes in many long established practices, not only of the large scale farmer and the nurseryman, but also of the backyard gardener.

Soil fumigant experiments have furnished dramatic proof that nematode parasites of plants may cause serious damage to crop and ornamental plants in all parts of the country. The old idea that nematodes are a problem only in the warmer regions has been discarded. Time after time, heavy nematode infestations have been located and controlled by soil fumigation in the Northern States. To some extent, this has been due to the recognition of new kinds of nematode parasites, but mostly it has been due

to an intensified search for nematodes suggested by increased crop growth after soil fumigation trials.

It has also become evident that control of nematodes sometimes has a very considerable effect in preventing infection of plants by fungi and bacteria. Results in control of Fusarium wilt of cotton and black shank of tobacco have been particularly striking, though the exact nature of the relationships between nematodes and these diseases is as yet obscure.

As growers have learned the advantages of soil fumigation, they have also learned that the effect of fumigating their soil is largely lost if nematode infected transplants are used. This has increased the demand for the seedbed fumigants among farmers who grow their own plants. It has also created a demand for nematode-free planting stock, not only for annual crops like tomatoes, but also for perennials, such as fruit trees, berry bushes and various kinds of ornamentals. This, in turn, has accelerated research to develop methods for producing nematode-free planting material. To some extent, production of each different kind of plant presents a different problem, and much remains to be done along this line. The few methods already worked out have

* November, 1952, Progress and Prospects in the Chemical Control of Nematodes.

been eagerly adopted by progressive nurserymen.

Manufacturers of soil fumigants have noted the growing popularity of home gardening and have realized that this is as yet an almost untouched market for soil fumigants. Attempts are now being made to develop this business by furnishing fumigants in small packages and in convenient forms for application with improvised equipment.

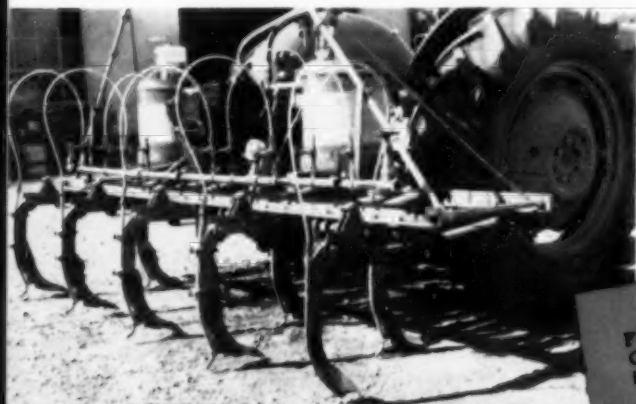
While it has been demonstrated that thousands of acres of orchards, citrus groves and vine yards, and numerous ornamental trees and shrubs are being seriously damaged by nematodes, the problem of control has not yet been satisfactorily solved. The

present soil fumigants can be and are being extensively used prior to planting, but may cause serious damage if applied around the roots of growing trees or shrubs. Efforts are being made to discover nematocides with reduced plant toxicity for this purpose, but none have yet been placed on the market.

Although application of the liquid soil fumigants is reasonably rapid and easy, it requires special equipment of a type unfamiliar to many growers, and even the best of the present applicators are subject to a variety of troubles which are very difficult to eliminate. In many instances, this has been an obstacle in the popularization of soil fumigation, and has led to numerous attempts to

make an entirely new approach to the problem. One of the most promising of these is suggested by recent experiments with liquid soil fumigants adsorbed on materials such as Hi-Sil, vermiculite or Panacalite, permitting application as granules instead of a liquid. Apparently adsorption of the fumigants does not interfere seriously with their efficacy. Application of the adsorbed fumigants is similar to application of the liquids in that the material is placed in bands a foot apart and 8 inches deep. This is as simple and rapid a method as the present one and has the advantage that certain types of fertilizer distributors can be adapted for the purpose.

(Turn to Page 109)



Facing page, top photo: Celery grown on muck land in Michigan. The plant at the left is a normal plant from fumigated soil, and the two at the right are from unfumigated soil heavily infested with root-knot nematodes and pin nematodes.

Facing page, bottom photo: Strawberries growing in fumigated soil on the left compared with growth in unfumigated soil on the right.

This page, top left: A soil fumigant applicator for use in the field. This type unit is used for application of

D-D or EDB. Fumigant is delivered at a depth of about 8 inches.

Center photo: Control of the nematode - Fusarium wilt complex of cotton by soil fumigation. Left, treated fumigation. Left, treated with DOWTUME W-35, 2 gallons per acre applied in the rows. Right, untreated check with missing and stunted plants.

Carrots from muck soil in Michigan. Those on left are from soil fumigated with 9 gallons of DOWTUME W-35 per acre. Those on the right are from adjacent unfumigated plots, infested with root-knot nematodes.

Photos by Dow Chemical Co.



MISSISSIPPI

AGRICULTURE and industry are teamed together for efficient production on the nation's crop lands. Industrialists, especially those who supply the farmer with chemicals, feeds or machinery, know the importance of research in this teamwork. However, some are not aware of the major roles played by 48 Land Grant Colleges through their agricultural experiment stations, maintained in cooperation with the U. S. Department of Agriculture.

The story of the Mississippi Experiment Station illustrates the mutual benefits which research can bring to farmers and the commercial firms which supply them the things they need. Since 1888 the Mississippi station has been engaged in studies designed to increase the efficiency of farm production and thereby raise the standards of living of both producers and consumers.

The first Station Bulletin, dated March 21, 1888, announced the organization of the Station. Then Bulletin No. 2, dated two months later, gets immediately into a subject of interest to readers of *Agricultural Chemicals*—chemical control of cotton insects. The insect was the cotton worm, the chemical Paris green, the equipment two muslin sacks tied on a pole, the power, of course, a mule. From this modest beginning to the multiple-row and multiple-job tractor

Agricultural Station

By G. C. Rutledge
State College, Miss.

combinations of today the Experiment Station has designed, developed, tested and proved methods and machines. More than 500 bulletins record progressive steps toward present-day standards.

Research findings have been translated into production in many fields, and there are numerous examples of high returns for dollars spent in agricultural experiments.

Investigations of anhydrous ammonia application represent a typical study undertaken at Mississippi Station. After three years' research on the efficiency of anhydrous ammonia for crop production and on development of equipment for applying it, the direct application of anhydrous ammonia was introduced by the Mississippi Station in March, 1947. The material was used on 80,000 acres that year. Anhydrous ammonia, at an average rate of 54 pounds nitrogen per acre, was used on more than a million acres of cotton, corn, small grains, truck crops, pastures and tung in 1951. Since its introduction, an-

hydrous ammonia has supplied a new and added source of nitrogen during a period of acute nitrogen shortage. Many farmers used anhydrous ammonia because they had already purchased full amounts available of conventional solid fertilizers. Anhydrous ammonia thus became an added source of nitrogen, without which crops would have been inadequately fertilized or not at all. It is impossible to assess this "scarcity" value of anhydrous ammonia, but it must run into millions of dollars. An "Economic Appraisal of Anhydrous Ammonia" (Circular 152) published in June 1950, indicates that anhydrous ammonia, where used in relatively large quantities, is purchased and applied to crops at a cost of \$1.51 per acre less than ammonium nitrate, the next cheapest source of nitrogen. On this basis, Mississippi farmers saved approximately \$1.5 million in one year alone. Its use has now spread nationwide and to many foreign lands.

Corn producers, using information developed by the Experiment

Station, have almost doubled per-acre yields in the last ten years. Early corn fertilization research indicated profitable returns only from relatively small applications of nitrogen. Exploratory work in 1944 and 1945 indicated the need for a balance between the number of plants per acre and the amount of fertilizer applied. In tests since 1946 in which varying amounts of N, P, and K, and varying numbers of plants have been used, results have served to take the limits off potential corn production. In all principal soil areas, 5-year average yields have been 52 bushels per acre for 60 pounds N and 8,000 plants, and 72 bushels per acre for 120 pounds N and 12,000 plants. This modern concept of corn production has rapidly come into general practice throughout the state, as indicated by the increase in per-acre yields.

Plant breeders at the Mississippi Experiment Station have played leading roles in the development of new improved varieties of important crops.

Recent releases include: (1) the Dixielee pea, which outyielded other varieties in four years of testing, and produces 8-inch pods of large high quality peas even in nematode infested soil, (2) the Magnolia cucumber noted for its heavy yields of small, dark green pickling cucumber, (3) the Contender bean which produced 90 more bushels per acre than its nearest rival in tests, (4) C. P. 36/111 sugarcane and Sart sorgho, new sirup-producing varieties developed in cooperation with the U. S. Sugar Plant Field Station at Meridian, (5) the Kopia tomato, a good shipper, (6) Delair, an early oat, (7) Dorman, an early soybean, and (8) Tracy, a high-yielding sorgho variety.

Weed Control in Cotton

Chemical weed control is especially important in the cotton-growing areas of Mississippi. A large item of expense in the production of cotton in the Southeastern states is the removal of weeds from the crop. Removal of

weeds from cotton by hand hoeing in Mississippi costs about \$15.20 per acre, making a total cost for the state somewhere between 36 and 48 million dollars annually, and involving between 120 and 160 million man hours. For the past five years, research studies on the use of chemicals to control weeds in cotton has been conducted in Mississippi. Considering only the small acreage treated in Mississippi in 1953, approximately 100,000 acres, the saving to farmers was on the order of \$800,000. This return in a single year is more than six times the total investment for five years of research. With the development of newer and more effective herbicides the savings to farmers would be even greater than realized so far. The constantly shrinking labor supply in the state has made it imperative that cotton growers make use of materials or methods for controlling weeds other than with hand labor. Herbicides are meeting this need, and ultimately may provide the missing link in the complete mechanization of cotton, and at the same time promote more efficient and economical production. Studies in progress show that chemical weed control is equally promising in other crops.

The Mississippi Agricultural Experiment Station has proved in recent years that beef and milk can be produced more cheaply in winter pastures than in feedlots in the South. Throughout the wide area where snow is rarely seen, Southern cattlemen have not been reaping the full benefit of their climatic advantage because of a lack of definite information on the subject of winter grazing. Tests on crops and combinations of crops, resulted in varieties which showed winter-hardiness and disease resistance; other studies led to better fertilization and cultural methods. At branch stations extending from the northern boundary of the state to the milder climate of South Mississippi the Experiment Station tested winter grazing on all major soil areas of the state. These studies revealed the best crops, seeding dates and fertilizer rates for each area. Typical of the sort of figures produced are these: Four-year averages at Holly Spring show it cost

Facing page, left photo: Direct application of anhydrous ammonia was introduced by the Mississippi Station in 1947, with use on about 60,000 acres.

Right photo: Herbicides kept the cotton at the right free of weeds. Tall weeds have overshadowed the cotton at the left of the photo.

a review of some of the agricultural projects studied at the 56 year old experiment station in State College, Miss.



Henry H. Leveck, associate director of the Mississippi Agricultural Station.

Dr. Clay Lyle, director of the station is also dean of agriculture school.



\$78 per steer for a winter feeding period in dry lot, compared to \$38 for the same period on ryegrass, and \$32 on fescue. Gains were somewhat lower on the winter pasture but profits were twice as great from ryegrass as from drylot feeding. On the dairy side, results of a two-year study at State College led research men to conclude that "winter pasture is an economical source of feed for the dairy cow, and winter pasture has a milk stimulating effect over and above its feed value." Pastures in this test increased milk production 4.8 pounds per cow per day. The studies do not indicate that cattlemen may depend upon winter grazing alone for feed. Some stored silage or hay is necessary insurance against weather hazards, and of course, dairy cows must have concentrates along with grazing. But the research has pointed the way to a wider and more profitable use of small grain forage and winter hardy grasses in feeding Southern livestock.

These achievements illustrate, but by no means encompass, the work of the Mississippi Agricultural Experiment Station. Under the leadership of director Clay Lyle and Associate director Henry H. Leveck, 91 professionally-trained scientists are employed in research full time and 54 college teachers carry on research projects on a part-time basis. About 700 projects and subprojects are now active at the central station and at the 10 branch experiment stations located in the major soil areas of the state.

Agricultural economists of the Mississippi Station are working on marketing of fruits, vegetables, poultry, eggs, seed crops, dairy products and cotton. They are also studying farm credit and farm adjustment in relation to mechanization. Agricultural engineers are concerned with equipment for irrigation, hay drying crop production and harvesting, and seed processing.

Projects in the field of agronomy include studies of all principal crops grown in the state. Breeding, fertilization and cultural practices for cotton and corn are major studies. Wheat, rye, barley and oats receive

attention, both as grain and as grazing crops. Pasture studies include clover and grass breeding programs and fertilization. Soil surveys of various counties are underway and there are a number of active projects in soil physics.

New drugs are tested in studies involving animal diseases. The animal husbandry department conducts a wide range of tests with beef cattle, sheep and hogs. Research on dairy and poultry problems is keyed to the

needs of these phases of the livestock industry. Timber cost and management studies help solve forestry problems. Fruit and vegetable research aids both the home producer and the commercial grower. Control of insects and plant diseases requires constant research to meet changing conditions.

The following project titles, selected from the station's long list of studies, show how agricultural chemicals are involved in much of the research program.★★

The development of chemical methods for the diagnosis of nutrient deficiencies of Mississippi soils.

Factors affecting the uptake of magnesium by plants.

The response of corn to magnesium and zinc.

The potassium requirements of Mississippi soils.

Boron requirements of crimson and white clovers for the production of forage and seed on several Mississippi soils.

The effect of chemicals on soil structure and plant development.

The effect of chemical stabilizers on herbicide practices.

The effect of placement of anhydrous ammonia relative to superphosphate on the availability of the phosphorus.

The role of tryptophane upon resistance of animals to parasites.

A survey of the coastal region of Mississippi to locate possible cobalt and other mineral deficient areas.

Protection of seeds from insect damage.

A study of some effects of aldrin, BHC, dieldrin and toxaphene on the boll weevil.

Fencepost preservation, treatability tests and service records.

Effect of growth regulating substances on development of flower primordia in cabbage.

Soil toxicity studies of insecticides applied to vegetable crops.

Effects of certain cultural and chemical treatments on production and quality of Concord grapes growing on Dog Ridge Rootstock.

A study of the effect of herbicides in relation to the control and physiology of weeds and crops.

A study of the effectiveness of herbicides in producing cotton, corn, lima bean and soybean without the aid of hoeing or cultivation.

The general response of cotton to plant growth-regulator sprays.

Chemical defoliation of cotton for boll weevil control and the use of herbicides to suppress pink bollworms.

Large-plot boll weevil control with sprays and dusts applied with tractor-mounted equipment.

Large-field boll weevil control with sprays and dusts applied with airplane.

Insecticide tests for control of several species of thrips attacking cotton.

Toxicity to beneficial, parasitic, and predaceous insects of various chemicals and formulations used in cotton insect control.

Organic insecticides for cutworm control.

Effect of organic compounds on mortality of the boll weevil within squares.

Factors influencing the tolerance of cotton to herbicidal oil.

The comparison and evaluation of chemical and mechanical methods of weed control in cotton.

Fly Control on Livestock



D. H. Moore
W. E. Dove
B. C. Dickinson

PYRETHRUM enjoys the unique position of having been one of the first insecticides employed in the United States, also one that has enjoyed increased usage over a period of 65 years, reaching maximum amounts in 1935. For the next ten years, its use declined, this being particularly evident with the advent of DDT and the subsequently introduced chlorinated hydrocarbons. Since 1945, however, supplies of pyrethrum have been increased, and its downward trend of use reversed, the resurgence reaching the point where today this botanical is one of the most widely used insecticides throughout the world for the protection of man, his animals and many of his food products.

Certain circumstances or developments have been closely associated with the use of pyrethrum as an insecticide. Perhaps the first of these was the appearance of kerosene extracts of pyrethrum in 1919. These afforded a more general use

of pyrethrum in the home and, of course, were the precursors of today's carefully defined household space sprays. Second, because of inadequate supplies for the war effort and the resulting development of DDT as its substitute for fly, mosquito and louse control in the armed forces, pyrethrum lost its preferred position. But this was of short duration, for five years later "fly resistance" had become so general that the necessary change from residual to space sprays, together with war-born shortages, hardly left enough pyrethrum to meet demands. The third development and perhaps the most important was the introduction and commercial use of "synergists" to extend

the available supplies of pyrethrum. The economy of pyrethrum-synergist combinations has permitted participation in many more control programs than previously would have been possible. Finally, one must not lose sight of the very characteristics that make pyrethrum the ideal insecticide. It has excellent knockdown properties, is effective against a wide spectrum of economic species, can be easily formulated in a number of ways, has an excellent record of safety against warm-blooded animals, and in the nearly 100 years of use in the United States, it has not been associated with the development of any pronounced species resistance.

Field evaluation of pyrethrins and allethrin each in combination with piperonyl butoxide for control of flies on livestock

*Research and Development Laboratories, U. S. Industrial Chemicals Co., Division National Distillers Products Corp., Baltimore.

TABLE 1
Field Evaluation of Piperonyl Butoxide-Pyrethrins Combinations, Formulated as Wettable Powders or Emulsions and Applied for the Control of Hornflies, Baltimore, Maryland, 1949.

Formulation	Percent of Active Ingrid.		Dilution Per 100 gal.	Test Animals		Flies/Animal Pre-Treatment Count	Av. Protection Period—Days
	Pip. But.	Pyreth.		Type	Number Treated		
Wettable Powder	10.0	0.75	40 lbs.	Beef	106	140	6
Wettable Powder	10.0	0.75	20 lbs.	Dairy	50	30	10
Wettable Powder	10.0	1.00	40 lbs.	Beef	101	95	10
Wettable Powder	10.0	1.00	20 lbs.	Dairy	50	39	10
Emulsion	11.84	1.18	2½ gals.	Beef	55	26	12

Much research has been devoted to the chemistry of pyrethrum. Four active principles have been isolated and the chemical nature of each defined. The allyl homolog of one of these (Cinerin I) is now produced commercially in considerable quantity and is known officially as allethrin.

It is the purpose of this paper to present results obtained over a period of several years, employing pyrethrins or allethrins in combination with piperonyl butoxide for the control of flies on dairy and beef animals.

Review of Literature

GNADINGER (8) (9) has described extensively the culture, chemistry and uses of pyrethrum and has provided a rather complete bibliography through 1945. More recently, Scholl and Arrick (21) published a bibliography of pyrethrum that includes both literature and patent references for the period 1850-1950. Sanders and Taff (18) have described the manufacture of allethrin, and Stoddard and Dove (22) have given an early appraisal of its biological activity. Wachs (23) described the chemical nature of piperonyl butoxide and pointed out the synergism demonstrated when it was used in combination with pyrethrins. Sarles, et al. (19) (20) showed by acute toxicity and irritation and later by chronic feeding tests that piperonyl butoxide was remarkably free from toxicological hazards to warm-blooded animals. Lehman (15) (16), in reporting upon pesticide chemicals currently

in use, indicated allethrin, pyrethrins and piperonyl butoxide all to be relatively safe as judged by acute oral, or sub-acute and chronic feeding tests.

Many experimenters have contributed field performance data on various piperonyl butoxide-pyrethrins combinations employed as animal sprays. McAllister (17) reported that wettable powders, containing 10 per cent of piperonyl butoxide plus 0.5 per cent of pyrethrins, applied at dilution of 24 lbs. per 100 gallons of water eliminated horn flies present at time of treatment and afforded residual protection for 3 days. Donohoe (4) found that emulsifiable concentrates containing 11.8 per cent of piperonyl butoxide plus 1.18 per cent of pyrethrins and diluted 1+9 with water gave excellent protection against all species of biting flies for 5 to 7 days. It was pointed out that both stable flies and horse flies were repelled by the treatment.

Howell (12) reporting on experiments for tabanid control found that a ready-to-apply emulsion containing 0.66 per cent piperonyl butoxide and 0.066 per cent pyrethrins consistently gave 3 days protection. Dove (5) summarized the results of experiments in eight states, all of which were designed for tabanid control. While duration of protection depended on concentration of ingredients and amount applied per animal, it was evident that a ready-to-apply spray containing 1.0 per cent piperonyl butoxide and 0.1 per cent pyrethrins, applied to point of run-off, afforded protection against

tabanids for 3-5 days. More recently, Goodwin, et al. (6) reporting on several seasons experiments, found an emulsifiable piperonyl butoxide-pyrethrins concentrate (10-1) diluted 1+9 to consistently give 5-7 days protection against horn flies and several species of horse flies. They considered this combination to have the best repellent properties of all materials tested.

Denning, et al. (3) reported on a four year study designed primarily for horn fly control. These experiments included most of the insecticides available at the time. Sprays that in final dilution contained 1 per cent piperonyl butoxide and from 0.05 to 0.075 per cent pyrethrins, formulated either as water emulsions or wettable powders, provided from 10 to 14 days protection. The authors pointed out that while this was a shorter protection period than that provided by several other materials, the safety of the combinations was a compensating factor that had to be given consideration. Laake, et al. (14) reporting on results from a three state co-operative test found that sprays containing 0.5 per cent piperonyl butoxide 0.05 per cent pyrethrins applied both to animals and their living quarters controlled horn flies for 7-12 days. It was noted that a thorough spraying of the quarters with the same combination, but at twice the concentration, reduced house fly population to a minimum for one week.

Knipling (13) noted that piperonyl butoxide-pyrethrins combinations, at concentrations of 0.5 and 0.05 per cent, respectively, were the only materials tried that would protect animals against stable fly attack for from 3-5 days.

Grady (7) reviewed the prerequisites of the oil-based stock spray. He pointed out that pyrethrins-synergist combinations answered most of these requirements in that they repelled as well as killed, were effective when applied according to directions, were effective against a wide variety of fly species normally attacking livestock and repeated daily applications did not alter the texture of the animal coat.

AGRICULTURAL CHEMICALS

Decker and Bruce (2) commenting on "resistance" noted that flies exposed to pyrethrins developed resistance very slowly, requiring even up to 30 generations of continuous exposure, whereas it was demonstrated that considerable resistance developed after 6 generations exposure to the chlorinated insecticides. Of more importance was the fact that strains of flies that had developed a tolerance for the chlorinated materials were still about as susceptible to piperonyl butoxide-pyrethrins combinations as "normal" flies. Hixson (10) (11) working with emulsifiable butoxide-pyrethrins concentrates (10:1), diluted 1 + 14, found that semi-weekly applications provided excellent protection against stable flies.

References to the use of gas-propelled sprays for fly control on cattle are very limited, however, a short article in *Chemical Week* (1) does give one an idea of the type of formulas under consideration.

Materials and Methods

SEVERAL emulsifiable concentrates were employed in these studies and all are referred to on a weight/volume basis. Thus, "emulsifiable piperonyl butoxide-pyrethrins 10:1" indicates a concentrate containing 10 gms. of piperonyl butoxide and 1 gm. of pyrethrins made up to a 100 ml. volume with emulsifier and odorless base oil. Wettable powders used in these studies were prepared by impregnating pyrethrum extract, piperonyl butoxide and an emulsifier (usually 2 per cent) on a diluent mixture of 2 parts Borden clay and 1 part Celite 209. One per cent of dispersing agent was added and then the powder was milled to break up any aggregates.

Both the emulsions and wettable powders were applied with a 50 gallon portable power sprayer operated at from 100 to 250 p.s.i. Animals were sprayed to the point of run-off, and this usually meant applying from 1 to 2 quarts per head. If two treatments were compared within the same herd, the animals were divided into two holding pens and marked with "Livestock Marking Crayon*" of various colors.

Horn fly counts were usually made every 2 days by counting the flies on one side of each of 10 treated animals. Pre-treatment counts were taken in a similar manner. Horn fly populations on beef herds of 25 or more per animal were considered as sufficiently high to call for retreatment. On dairy animals used in these experiments, fly populations were in general somewhat lower so any treatment was considered to have lost its effectiveness, when fly numbers had reached the pre-treatment count.

Most of the data on stable fly control were obtained by a semi-laboratory method. To make a comparison of two formulas, a single animal of uniform color was used. Treatment was made to one side at the time the opposite side was covered with a cloth to prevent deposits from a drift of the spray. The procedure was repeated on the other side with the second formula, and then the animal was put in a stall where stable flies were numerous. When the experiment was repeated, the order of treatments was reversed, after first giving the animal a thorough washing with soap and water. Treatments were evaluated on the basis of the number of flies landing over a five minute period. Counts were made daily.

In field tests designed primarily to evaluate treatments for the control of horse flies only, the emulsifiable concentrates were evaluated and these at dilutions of one volume of concentrate plus nine volumes of water. Counts were usually made daily and represented the number of horse flies on the animals at the time the entire body was quickly examined for flies.

In the study of gas-propelled sprays for fly control on cattle, all formulations were filled in conventional 12 ounce aerosol containers (Continental cans equipped with Continental valves that delivered approximately one gram per second). The propellant used, while varying in total amount, was with one exception comprised of equal proportions of Freon 11 and 12. The ex-

ception, formula "L", contained only 25 percent of Freon 12.

The manner in which these aerosol formulas were applied depended on the predominant species of flies present. If horn flies were most abundant, the animals were sprayed along the back and belly lines. If stable flies were especially numerous, the spray was applied up the forelegs, across the back and down the hind legs. In all cases, the container was held approximately 18 inches from the animal. The spray time varied from 1-3 seconds on each side, depending on the species of flies involved and the size of the test animal. Treatments were usually made in the morning, immediately before turning the cattle out to pasture, and then at hourly intervals, counts were made for the next six hours. In some cases, counts were made throughout the day until the evening milking. Counts of horn flies and stable flies were taken by scanning the animal once, while that for house flies represented the number alighting over a 5 minute period. The formulas evaluated were as follows:—

- A. 0.20% pyrethrins
2.00% piperonyl butoxide
3.00% Methoxychlor
5.00% methylated naphthalenes
9.80% deodorized base oil
80.00% propellant
- B. 0.20% pyrethrins
2.00% piperonyl butoxide
3.00% Methoxychlor
2.00% Thanite
5.00% methylated naphthalenes
17.80% deodorized oil
70.00% propellant
- C. 0.20% pyrethrins
2.00% piperonyl butoxide
3.00% Methoxychlor
4.00% Lethane 384
5.00% methylated naphthalenes
15.80% deodorized base oil
70.00% propellant
- D. 0.25% pyrethrins
2.50% piperonyl butoxide
3.00% Methoxychlor
5.00% methylated naphthalenes
19.25% deodorized base oil
70.00% propellant
- E. 0.25% pyrethrins
2.50% piperonyl butoxide
3.00% Methoxychlor
5.00% methylated naphthalenes
4.25% deodorized base oil
85.00% propellant
- F. 0.50% pyrethrins
4.00% piperonyl butoxide
10.50% base oil
85.00% propellant

*Obtained from Lake Chemical Company, 3652 W. Carroll Street, Chicago 12, Illinois.

- G. 0.50% pyrethrins
4.00% piperonyl butoxide
25.50% deodorized base oil
70.00% propellant
- H. 0.40% allethrin
2.00% piperonyl butoxide
3.00% Methoxychlor
5.00% methylated naphthalenes
19.60% deodorized base oil
70.00% propellant
- I. 0.25% pyrethrins
2.50% piperonyl butoxide
3.00% Methoxychlor
5.00% methylated naphthalenes
4.25% deodorized base oil
85.00% propellant

J, K and L contained the same active ingredients as "I" but were provided with 70, 50 and 25 percent propellant, respectively, with correspondingly increased amounts of odorless base oil.

Discussion of Results

a. Horn Fly

The results of several sprayings for horn fly control conducted in

1949 are given in Table 1. Using wettable powders containing 10 per cent piperonyl butoxide and either 0.75 or 1.0% pyrethrins, good protection was obtained against this species for periods ranging from about one week to 10 days. There were no direct comparisons of the 40 and 20 lb./100 gal. rate within the same herd. The fact that both treatments using the 20 lb. rate gave as long or longer residual protection than the 40 lb. rate was apparently due to the lower fly populations involved. While there was only one comparative test employing the emulsifiable concentrate (10-1), the results suggest that when the active ingredients were equally applied, emulsions would be fully as effective as wettable powders.

Allethrin was included in the 1950 and 1951 experiments. These results are given in Table 2. In all cases, the piperonyl butoxide-allethrin emulsion has been compared directly with a piperonyl butoxide-pyrethrins (10-1) standard emulsion, consequently, both were subjected to comparable fly populations. It was not possible to take fly counts each day but from those that were taken, one can estimate reasonably well when horn fly populations would have reached 25 per animal and so would have called for re-treatment. Rather extensive laboratory studies with house flies have already shown that it would not be feasible to substitute allethrin for pyrethrins and

(Turn to Page 109)

TABLE 2

Summary of Field Experiments Comparing Piperonyl Butoxide-Allethrin and Piperonyl Butoxide-Pyrethrins Emulsions for the Control of Hornflies, Baltimore, Maryland, 1950-51.

Test	Conc. of Act. Ingrid. g/100 ml.				Test Animals		Count — Flies per Animal												Approx. Period of Protection Days	
	P.B.	All.	Pyre.	Dilution	Type	No. 1 Treated	Pre- Treat.	Days After Treatment												
								2	3	4	5	6	7	8	9	10	12			
A	10	2	—	1/19	Dairy	30	42.1	0.4		1.9		8.1			19.6			10		
	10	—	1	1/19	Dairy	35	44.3	0.0		0.5		4.8			18.5			10		
B	10	2	—	1/19	Beef	20	64.8	0.1		2.4		4.0			48.0			7		
	10	—	1	1/19	Beef	20	64.8	0.0		8.6		3.2			30.2			8		
C	10	2	—	1/19	Beef	20	78.0	0.6		4.6		12.6		14.2		13.0	34.8	11		
	10	—	1	1/19	Beef	20	78.0	1.2		4.4		7.2		7.0		17.4	45.8	11		
D	10	2	—	1/19	Beef	50	86.4		0.4		3.8		71.0					6		
	10	—	1	1/19	Beef	50	86.4		0.0		1.6		26.8					7		
E	10	2	—	1/19	Beef	30	153		2.6		27.2		112					5		
	10	—	1	1/19	Beef	30	153		1.2		12.2		68					6		
F	10	2	—	1/19	Dairy	15	212		4.8		21.9		67.6					5		
	10	—	1	1/19	Dairy	15	212		2.1		11.8		54.0					6		
G	10	2	—	1/9	Beef	20	127	0.6		9.8		13.8		19.4		31.2		9		
	10	—	1	1/9	Beef	20	127	0.6		4.4		15.2		8.7		29.4		9		
H	10	2	—	1/9	Dairy	30	22.1		0.2		3.7			8.2			20.4	12		
	10	—	1	1/9	Dairy	30	22.1		0.0		0.9			4.7			16.1	12		
I	10	2	—	1/9	Beef	50	200+	0.5		32.5		60.0						4		
	10	—	1	1/9	Beef	50	200+	0.8		13.2		35.4						5		
J	10	2	—	1/9	Beef	20	42	0.6		24.6								4		
	10	—	1	1/9	Beef	20	42	0.2		10.5								5+		
K	10	1	—	1/19	Dairy	12	45	0.1		9.3		21.5				34.6		9		
	10	—	1	1/19	Dairy	10	45	0.1		4.3		14.1				11.9		11		
L	10	1	—	1/9	Beef	50	200+	1.8		32.6		72+						4		
	10	—	1	1/9	Beef	50	200+	0.8		13.0		35.0						5		
M	10	1	0.5	1/19	Beef	20	100+	0.2		10.4		58.6						5		
	10	—	1	1/19	Beef	20	100+	0.0		3.2		39.2						5		
N	10	1	0.5	1/19	Beef	15	37.4	0.5		4.5		10.1		21.9		24.8	33.3	10		
	10	—	1	1/19	Beef	15	37.4	0.3		1.2		5.6		8.3		11.7	44.0	11		

*Treatments D, E, F, J and M received an average dose of quart/animal, while all others received 1.5 quarts.

†Heavy rains occurred after treatments A, C, and G; moderate after treatment H; and light after treatment B.

The SULFUR Story

by **E. Meier**
Correspondent

JUST three years ago sulfur users were confronted with sharp restrictions and allocations, and sulfur producers were investigating all means of sulfur recovery to meet the pressing demand from both domestic and foreign buyers for every pound of sulfur that could be produced.

The outbreak of hostilities in 1950 led to increased government and industrial demand for sulfur . . . and most other chemicals . . . to a point that could not be met with normal production. Domestic and foreign requirements had U. S. producers digging into sulfur stockpiles to fill orders, and it soon became evident that other sources of supply had to be found, since reserves and production were rapidly being depleted.

To conserve dwindling stocks, government controls were put into effect June 1951. The government also placed sharp restrictions on exports, extending so far as to control overseas sales of pesticides, which included sulfur as diluents. Sulfur producers themselves instituted allocation programs for domestic distribution. By 1952, agricultural sulfur consumption, of necessity, dropped from 274,000 long tons in 1950 to 198,000 tons in 1952. (Although the domestic supply situation eased by the end of 1952, agricultural consumption of

elemental sulfur for 1953 is estimated at only 196,000 long tons.)

In 1953, the United States produced an estimated 6.3 million tons of sulfur . . . only a shade above the 1952 output. Shipments of sulfur from U. S. mines for the first five months of 1954 totaled 2,143 thousand tons, a drop of 250,000 tons from the 2,396 thousand tons shipped during the same period in 1953. These figures would seem to indicate that demand has dropped somewhat from the levels of two years ago, for officials of the major producing companies indicate supplies are currently adequate to meet demand. Without data on sulfur stocks for '53 and the current year, it is difficult to draw conclusive statements on the supply picture. A look into production expansion may explain the optimistic outlook, however.

In 1950, there were only four major sulfur companies in the U. S. . . . Texas Gulf, Freeport, Jefferson Lake, and Duval. 1952 marked a period of sulfur shortages, extensive expansion projects and frantic prospecting for new supply sources. Today, there are two new Gulf Coast outfits — Standard Sulphur Co. and Lone Star Sulphur Co. New sulfur capacity for 1954 is also coming from plants in New Mexico and deposits discovered in southeast Louisiana.

Louisiana Developments

THE Louisiana deposit spotted on the marshland near the Mississippi mouth is Freeport Sulfur Co.'s new plant in Garden Island Bay. The mine began producing sulfur in November 1952, and is designed to supply 500,000 tons annually. It is reported to be the largest sulfur development to be carried out anywhere in the world in the past two decades. Freeport also began operation late in 1952 of a mine in Bay St. Elaine, La. Still another plant under construction is a 150,000-200,000 ton plant (annual capacity) at Chacahoula, La., expected to be in operation early in 1955. The great bulk of Freeport sulfur production continues to come from the Grand Ecaille mine, which is reported to have extensive reserves. On the other hand the Freeport Hoskins Mound in Texas experienced a further decline in production in 1953 and is now very near the end of its life.

Prospecting in Mexico

PROSPECTING for sulfur deposits outside the United States has had its biggest play in Mexico. Some five or six U. S. companies are in on the scramble, but reports over recent months have centered on stock sales and expansion programs. Actual production at this stage has been announced for the Mexican Gulf Sul-

phur Co.'s plant in San Cristobal, which has been under construction since 1952. Since the start of production on March 15, 1954, more than 20,000 tons of sulfur are reported to have been produced, and recent advance sales total 10,000 tons. The plant is designed to produce about 200,000 tons a year from reserves estimated at 11,000,000 tons.

Pan American Sulphur Co., operating in Mexico under its subsidiary Gulf Sulphur Co. de Mexico S.A., has a \$5.5 million plant under construction on the Jaltipan domes, with annual capacity of 500,000 tons. A third company, The Gulf Sulphur Co., claims to have found sufficient sulfur through preliminary drillings to warrant construction of a plant this year. Texas International Sulphur Co. of Houston early this year joined with Central Minera S.A. of Mexico City to undertake exploration and development of land in Vera Cruz. Texas International has a plant under construction near San Felipe in lower California.

The extent of Mexican sulfur potential is still to be realized. Several U. S. companies are rumored seriously considering entering the sulfur race in Mexico, and carefully watching developments in this area. With sulfur requirements expected to rise considerably in the next few years, and U. S. sulfur sources of questionable quantity, domestic users look hopefully to successful mining operations in Mexico.

Domestic Supply Limited

SULFUR producing areas in the United States are located in a few tremendous deposits in the Louisiana-Texas coastal plain. Unlike the leading traditional foreign sources of sulfur, the Gulf Coast deposits consist of practically pure brimstone that can be brought to ground level at relatively low cost. The deposits, however, have been mined continuously since the introduction of the Frasch process in the United States during World War I. Output of the Gulf Coast domes now exceeds 5 million tons annually, exclusive of the Garden Island Bay, and deposits are

estimated at 100 million tons or so. However, the honeymoon may soon be over, since the U. S. Bureau of Mines estimates that the Gulf Coast deposits could peter out in 20 years or so unless new discoveries are made. One of the largest producers of sulfur estimates that nearly 200 dome structures along the coast of the Gulf of Mexico have been investigated over the last half-century, but only 14 have produced sulfur in quantity.

Last year (1953), 80 per cent of the total tonnage of sulfur produced came from brimstone sources via the Frasch process, 7½% came from pyrites, 4½% from smelter gases and 9½% from sour natural gas and sludge. The Frasch process results in a pure form of sulfur, but can be used economically only in deposits of high sulfur content. Briefly, the process consists of pumping superheated water into the rock dome to melt the sulfur and then raising the melted sulfur with an air-jet lift. From 2000 to 3000 gallons of water are needed per ton of sulfur.

Peak Sales in 1953

PPRICE controls during the sulfur shortages two years ago held the price of Gulf Coast brimstone down to \$22 a ton. By contrast, at the height of the shortage, foreign prices shot up to as high as \$100 a ton. When controls were lifted early in 1953, domestic prices advanced to \$27 a ton. All time peak sales were reported for 1953, although the tonnage in some cases was under previous levels, the explanation being, of course, the average price boost of approximately \$5.00 per ton in effect the last seven months of 1953. A further price increase, effective January 1, 1954, raised the price of sulfur another \$1.00 per ton.

World prices for sulfur dropped during 1953 and continued to plummet in 1954. They now range anywhere from \$35 to \$65 a ton. However, this reaction represents the demise of high-cost sources of sulfur or sulfuric acid which were operated during the shortage period after the Korean War.

It is estimated that the United

States produces somewhat less than 50% of the total world sulfur supply, and of this total, four-fifths of the sulfur is made into sulfuric acid.

Supplies of sulfur in 1954 have been adequate for all industrial needs. Barring any upsetting situations, such as an accelerated defense program or actual war itself, there should be no shortage felt during the remainder of this year.

A sharp rise in the United States' demand in the immediate future, much above 7,000,000 long tons per year, could create at least local shortages. Once again more expensive methods of recovering sulfur may have to be employed to meet the excess demand.

Long-term thoughts on sulfur are that with costs mounting and sulfur becoming more difficult to find and develop, and with deposits leaner and less accessible, the price structure on sulfur will probably be revised upward in succeeding years.

DuPont Shifts Canada Sales

Du Pont Company of Canada, Ltd. will in the future re-sell the Grasselli line of agricultural and industrial chemicals formerly handled in Canada by Canadian Industries Limited which was divided July 1 into two new companies. Merle E. Ward, a former Grasselli agricultural sales representative, is manager of agricultural chemicals sales for du Pont of Canada. The du Pont agricultural line, which includes weed and brush killers, plant and turf fungicides, insecticides, seed disinfectants, etc., is manufactured in the United States, and shipped to Canada for sale there under the du Pont brand name.

Building Costa Rican Plant

Quimicas Agricolas Centro-Americanas Ltda., Apartado 2560, San Jose, Costa Rica, is building a plant in San Jose for the formulation of liquid and powder insecticides for sale in the Central American market. It is anticipated that the plant will be completed and in operation by January 1, 1955. Engineer in charge of construction is Joseph P. McKenna.

AGRICULTURAL CHEMICALS



Exterior view of the new insecticide compounding building put into operation at University of California's Riverside campus.



Compounding equipment and work area is shown in this view of the building. Equipment includes modern mixers and mills.

U. of Cal. builds unit for

Testing Insecticides

IN testing experimental insecticides, it's necessary to store and formulate a large quantity of new materials each season. To facilitate its activities in this line, the University of California recently put into operation its new insecticide compounding building on the Riverside campus.

Pictures on this page show the one-story concrete and Transite build-

ing which is being used for storage of bulk and finished insecticides and diluents as well as a laboratory for formulating insecticidal compounds. The building is 120 feet long and 60 feet wide. The University's Department of Entomology is utilizing the structure, according to the department chairman, R. L. Metcalf.

The storage area measures 80 ft. by 40 ft. and includes 16 cubicles

for storing insecticidal materials for use in various departmental projects, a large fume hood for handling or repackaging toxic materials, a 50-ft. chemical bench for rough laboratory work and equipment for small scale formulation studies.

Drums of spray oils and other liquid formulations are stored in a roofed but open-sided area nearby. Part of this area houses compounding and mixing equipment. These facilities include ribbon mixers with atomizers for solvent impregnation, hammer mills, ball mills and steam-heated kettles for preparing emulsion concentrates. Special safety features include eye-wash fountain, safety shower, cross ventilation and water-washed exhaust blowers for all mixing devices.

Oil storage dock, compounding area and equipment is shown from this view. Much has been added since this early photo.



Interior view of storage room, showing fume hood and some of the individual storage bins used for various testing projects.





By Don Lerch

Washington, D. C.

WHETHER you view the Mid West from a series of statistical tables or the window of a modern airliner, what you see is a center of tremendous wealth and promise for the agricultural chemical industry. The list of companies doing business in this area reads like a Who's Who of American industry.

In cold figures, the potential fertilizer consumption in Iowa is staggering. On a conservative basis, assuming that Iowa farmers will someday soon apply as much fertilizer as their Ohio neighbors, total usage in the tall corn state would jump to four million tons! This would be one fifth of all the fertilizer consumed throughout the entire United States during the 1953 fertilizer year. At present, Iowa farmers apply only fifty pounds of fertilizer per average harvested acre. In Ohio, the figure is slightly over two hundred.

Iowa is but one of the 12 states in the general area we are including in this particular estimate of the prospective market. The USDA calls it the East North Central region and the West North Central region. It contains nearly half of all the harvested acres in the nation. Yet it ac-

counts for but a trifle over one-third of total fertilizer consumption.

By itself, even this comparison fails to give a realistic picture of the area. The most important development is in the minds of many key agricultural leaders who are convinced that the per acre application of fertilizer is going to come within hailing distance of the historic heavy consuming parts of the nation. When this happens—look out!

Pesticide manufacturers too are eyeing the Mid West for the great market it offers for the continuously growing array of insect and disease control materials. To this long list must be added a newcomer that may someday crowd its parents for top rung—the herbicide and hormone treatments available for weed control and many other physiological aspects of plant growth.

Yet, taken from just the opportunity of controlling one insect, the European corn borer, the industry has a market which could be worth millions. Next to hay, corn is our largest crop. In some years losses because of this one pest have approached ten percent of the crop. Based on market prices, the loss was recently estimated by the government at \$350 million dollars for a single

year. While progress is being made in spreading the area of corn production, it still remains in the Mid West, centered in Iowa.

The concentration of harvested acres in the Mid West offers still another big market for the agricultural chemical industry through the sale of weed control chemicals. It has been estimated that weeds cost South Dakota farmers as much in one year as does the state government in two years.

Research findings are making more and more farmers conscious of the profits to be expected from controlling weeds. A variety of data is being used in a number of ways. For instance, it has been found that a thousand pounds of wild oats use as much plant food as 25 bushels of barley. Also, that a ton of mustard will pull 75 pounds of nitrogen from the soil, while the same amount of wheat takes only 33 pounds. In Minnesota, farmers are being told they are paying for weeds at the rate of \$6 per acre on crop land, \$3 per acre on noncrop land.

A huge mass of experimental data is ready to help the industry sell its products. From a "chemical point of view", the Mid West is in the initial stages of development.

AGRICULTURAL CHEMICALS

Actual figures of pesticide movement seem harder to come by than those of the fertilizer industry. The data available as analyzed by H. H. Shepard, USDA Commodity Stabilization Service, shows that about a fourth of the total production moves into the Mid West. From the number of new plants and distribution facilities being established in the area, it will become much greater.

The Mid-Western Farmer

NOW, to omit the figures and take a look at the Mid West as it appears at this stage of its transition. Give and take for the usual expected variations.

This area contains great natural soil fertility. It is a marvel of the world. Scratch a furrow, drop a seed and it fairly leaps from the ground. The rich dark earth has been able to produce in abundance year after year with no chemicals to prop it up.

Mid Western farmers are among the best in the world. They have combined a cropping program with an animal agriculture which has made them prosperous and able to take advantage of our developing economy. Their acres of lush crops and fields of cattle and hogs are an inspiration for all who see them.

The War telescoped decades of transition into a few years. One of the biggest impacts on the agriculture of this area is the high wage rates paid by industry. This meant that the farmer either lost his help or did without. If he invested more money, he could buy more machinery and do more with less labor. Most of them did the latter.

This investment is large and it is important for it is overhead cost which the farmer must carry and pay out of crop and livestock income. Within a few years after the war, the Midwestern farmers investment in farm machinery had increased four times that of pre-war. It is now running about six times that figure.

Investment in machinery dictated other changes. In some cases it resulted in buying more land to provide enough work to make the machinery pay. Other farmers increased

the size of their livestock or poultry operations, often necessitating an increase in investment in buildings and other facilities.

Any way you look at it, the farmer has been spending money at a terrific rate. This can be measured in the size of the farm debt which has been steadily increasing. The increase is in both long term and short term credit. It is at an all time high.

At the same time farmers' expenses are mounting, their income declining. While this decline has been less in some Mid Western states than elsewhere, it is enough to make itself felt. It ranges around 5 per cent.

The farmer's reaction, is the same as yours would be. He is trying to make up for his loss of income in every way he can. In doing this he is facing-up to several major problems.

His soil isn't wearing thin, but it often doesn't pay the overhead at today's prices. In some areas yields are down considerably. In others, the soil still seems nearly as productive as ever, but with present prices and debt load, that isn't enough.

Consequently, the agricultural chemical industry is being called on by an increasing number of farmers to help them make ends meet. The happy part of the story is that in most cases the industry has the right tool with which to do the job.

Increased applications of fertilizer are boosting yields of corn and grains to new highs. Pesticides and herbicides are protecting the crops and making it possible to "bank" a greater percentage of the total yield.

As we are driving toward higher yields, there is greater chance for error and loss. A farmer who applies more fertilizer, but who neglects to protect his investment with pesticides, stands to lose more than his neighbor who applies little or no fertilizer. Clearly, the day of the businessman-farmer is here; for if he fails to balance the many new ingredients in his operation, he is bound to encounter losses instead of catching up with rising expenses.

The farmer needs all the advice he can get from agricultural experi-

ment stations and county farm advisors. But perhaps even more important, he needs more and better advice on his management problems.

Role of the Banker

IN this connection the fertilizer industry is making notable progress in building closer relationships with the bankers. The country banker who finances the purchase of fertilizer and pesticides can be a major influence in expanding the usage of both types of products. Unless the banker has a basic understanding of the role of these materials in crop and livestock production, he may be unwilling to advance the cash for their purchase. Furthermore, if a banker is unwilling to risk the bank's money for these production items, why should the farmer?

The National Fertilizer Association is making its banker program a major part of its activity. Officers of the Association are maintaining close contact with national and state banking groups. A visible part of the results is in the form of written and spoken messages from bankers endorsing the use of fertilizer in accordance with the recommendations of the agricultural experiment station of each state.

Here's what one Mid West banker has to say about loaning money to buy fertilizer: "For the past two years, we have made loans to our customers for purchase of fertilizer and other soil improvement practices at 4% interest. A large number of our farmer customers have taken advantage of this service and we feel that a loan for this purpose is a good investment in the future of our community."

Because of the decline in farm prices and rather severe cutbacks in acreage for 1955, it is particularly interesting to get this banker's thinking on what lies ahead. In part he says, "We do want to encourage you to continue taking a long-term viewpoint on management of your land and livestock. Though farm prices have dropped and production costs are high, keep your sights set on the goal that you and your family
(Turn to Page 105)

100 Years of Entomology

PART III

CONTEMPORARY ENTOMOLOGISTS CONTINUE REVIEW OF THE PAST 100 YEARS OF DEVELOPMENT AND PROGRESS



A Century of INSECT LOSSES

By C. G. Decker

Illinois Natural History Survey and
Illinois Agricultural Experiment Station

IN the processes of creation and evolution insects became fully entrenched on this planet long before the appearance of man, and they have challenged with more than a little success man's every effort to displace them. They are man's formidable competitors for food, they attack and often destroy his garments, his livestock, and even his dwellings. In utter contempt of their adversary they proceed to disturb man's slumber, suck the blood from his veins, and at times decimate whole communities through the dissemination of some of the most dreaded diseases known to man.

Those who have not studied natural history and are only vaguely familiar with the details of man's eternal conflict with the insect world are often prone to feel that insect plagues are relatively new, and that each insect problem encountered for the first time is surely something heretofore unknown. Such is obviously not the case. The many references to insects that appear in the Bible, in the hieroglyphics of the Egyptians, and in the writings of the Greeks are ample testimony that the peoples of these ancient civilizations were beset by many insect problems.

Insects were by no means the least of the trials and tribulations endured by the American colonists. They found the American forests, marshes, and prairies teeming with insect life. Mosquitoes, flies, tabanids, blackflies, ticks, mites, and lice at times amounted to a scourge for man and beast alike. Then as lands were cleared and planted to crops, many native and newly introduced insects (which had hitchhiked to America with the colonists) found this new environment to their liking and increased a hundredfold. The farmer, not knowing how to control the pests, went on share-cropping with the insects.

As time went on and certain particularly obnoxious pests—apple worms, plum curculios, cutworms, armyworms, chinch bugs, grasshoppers, etc.—began taking a greater share of each crop, desperate farmers effectively demanded governmental aid in the development of suitable protective or control measures and insisted that scientists be appointed to study such problems. Thus with the appointment of Asa Fitch as Entomologist of New York and Townsend Glover as Entomologist in the U. S. Patent Office in 1854, a new

profession, economic entomology, came into being.

As these men and others who soon joined their ranks began their studies, beleaguered farmers were able to contribute valuable observations and notes which, when digested and assimilated, were rapidly converted into an amazingly large volume of entomological knowledge. With these centers pouring out useful information about insects, their habits, and preventive or control measures, farmers and the public at large became more and more insect conscious.

As might be expected some complained, "We never had such insect problems before those entomologists were appointed," which, of course, was no more logical than an assertion that bacteria did not exist prior to Pasteur's discoveries or that cosmic rays had their origin in the 20th century. Admittedly some of our most destructive insect pests are recent immigrants from abroad, but well over three fourths of our present day insects are indigenous to North America or had become well established in this country prior to 1950. In fact a great many of the insects currently regarded as pests were at least mentioned in a book entitled "Insects Injurious to Vegetation," first published by T. W. Harris in 1841. Obviously the American farmer had long been confronted with serious insect problems but the number and magnitude of such problems had not been widely publicized.

However, even today with a large percentage of our population concentrated in cities far removed from farm problems, the average layman has a very vague concept of the magnitude of our losses attributable to insects.

A flat assertion that the value of crops and farm produce destroyed by insects in the last 100 years is some-

AGRICULTURAL CHEMICALS

In this issue,

G. C. Decker

C. E. Palm

E. R. McGovran

R. L. Metcalf

thing in excess of one hundred billion dollars (\$100,000,000,000) will no doubt be received with skepticism if not, indeed, disbelief, yet such is the case, and one need scan only a few historic records to uncover considerable evidence to support such a contention. In the opening pages of the *American Entomologist*, 1868, an editorial, presumably written by Benjamin D. Walsh, contains these interesting comments: "Few persons are aware of the enormous amount of wealth annually abstracted from the pockets of the cultivators of the soil by those insignificant little creatures, which in popular parlance are called 'bugs,' but which the scientific world chooses to denominate 'insects' . . . Scarcely a year elapses in which the wheat crop of several States of the Union is not more or less completely ruined by the Chinch-bug, the Hessian Fly, the Wheat Midge, or the Joint Worm . . . The Hop Plant-louse—a recent importation from Europe—has for the last three or four years diminished the value of the hop crop of New York by at least one-half . . . the Hateful Grasshopper, in particular seasons, swoops down with the western breeze in devouring swarms from the Rocky Mountains, and, like its close ally, the Locust of Scripture and of Modern Europe, devours every green thing from off the face of the earth . . . the cotton crop is often diminished at least one-third in value by a single insect—the Cotton-worm—thus at one fell swoop picking the pockets of the nation of some fifty millions of dollars." In summary Walsh concluded " . . . the United States suffer from the depredations of noxious insects to the annual amount of THREE HUNDRED MILLIONS OF DOLLARS."

That, of course, was as of 1868. From time to time others have ventured estimates on agriculture's an-

nual insect losses: Fletcher (1891), \$380,000,000; Forbes (1915), \$700,000,000; Cooley (1918), \$1,400,000,000; Hyslop (1938), \$1,601,527,000, and Decker, Hall and others (1954), \$4,000,000,000. Some of these estimates were evolved by combining estimates made for a number of notorious pests, while others were based on the rather generally accepted belief that by and large, year after year insect losses amount to about 10% of our agricultural production. Adding the estimates given to comparable values for the intervening years, one finds that accumulated losses, 1854-1954, are in excess of one hundred billion dollars. By combining annual agricultural production values found in *Agricultural Statistics* or *Department of Agriculture Yearbooks* and applying the 10% factor, which in the light of recent research is now considered to be ultra-conservative, one arrives at substantially the same figures.

Insect losses, of course, are not confined to agricultural crops and produce, for insects are notorious destroyers of fabrics, furs, etc., and then, too, damage to ornamental

plantings, shade trees, homes and structures of all types, though never adequately estimated, must run into millions of dollars annually. Also, it is well nigh impossible to place a dollar value on such intangibles as annoyance, discomfort, sickness, and death where man himself is attacked by a host of nuisance and disease bearing insects. One need only point out that during the Civil and Spanish-American Wars American casualties from insect-borne diseases far exceeded those from cannon or gunfire, and that between 1850 and 1920 deaths from insect-borne diseases such as malaria, yellow fever, typhus, plague, typhoid and tick fever ran into the thousands each year.

The American public, past and present, has in a very large measure failed to recognize or has chosen to ignore the magnitude and significance of its insect problems. Certainly it can take little pride in the fact that in the last one hundred years indirect taxes imposed and collected by insects equal or exceed all taxes levied and collected for the support of its public school system.★★



Entomological Problems on the Increase

By Charles E. Palm

Cornell University
Ithaca, N. Y.

AS we take stock of the accomplishments of the profession of entomology on this centennial year, it is gratifying that those responsible for recognizing the importance of a professional attack on insect losses were able to receive public support beginning in 1854. Had it not been for the fine work of the men who pioneered the work in insect control and companion efforts in the chemical and equipment fields, we would not be able to attack many of the problems today with a feeling that

success is possible. We know that pest control is a dynamic business and to speak of future problems, in terms of how they will be approached, is a bit uncertain. Many new areas of benefit from pest control are opening with the availability of new chemicals and equipment. The past ten years have been the most significant perhaps of any we have experienced, and from them we can see a few of the needs for the immediate future.

The development of resistance to insecticides is increasing the demand

for more basic research in the fields of insect physiology, biochemistry and genetics. Unfortunately we have not supported research in insect physiology sufficiently well in the past to provide us with much of the information now needed to understand the normal physiology of a species. Thus when we get involved with toxic action and abnormal physiology, the problems become even more difficult. Research in the fields of mode of action and pharmacology of insecticides will expand as rapidly as funds can be found to support them. The annoying problems of insect resistance may in turn do much good for the long pull in entomology by making possible financial support to the workers in fundamental physiology. As with any basic investigation, no timetable can be established for obtaining results, but accomplishment already is being turned up and more will follow from the research in these vital areas.

The accumulation of pesticidal chemicals in the soil is another field that will need attention in the future. We really are too inexperienced in the use of many of the pesticides to know what happens to the toxicant when it is applied in normal manner in terms of what proportion, if any, reaches the soil and accumulates. Continued use may build up levels of particular chemicals in the soil which can be toxic to certain crops. There are reports already of some materials building up to levels where sensitive crops are affected. The need for developing analytical methods for insecticide residues in the soil is a most important one at present. Both chemical and bio-assay methods need to be developed and compared since it may be possible to do more for some time to come with bio-assay than with chemical methods. This type of research should go on in several sections of the country because it is a long-range type of program and we need to know the answer to some of the questions of rate of accumulation of a given chemical under varying climatic conditions.

It seems obvious that, in the future, greater attention will be paid to the field of insect ecology. We appreciate more every year the tremendous value of natural and biological control as we run into natural balances that have been destroyed as

the result of pest control practices. The complicated effects of biological and physical factors in the environment that regulate the population levels of insects must be better understood. In a few outstanding examples, we do know enough to be able to forecast population behavior to some extent. The problem is as

In this series on the entomology centennial, the June issue of *Agricultural Chemicals* contained reports by H. H. Shepard, H. H. Ross, C. R. Neiswander, W. L. Baker, E. D. Essig, and P. J. Chapman; the July issue, carried reports by F. C. Bishopp, E. N. Cory, J. J. Davis and E. F. Knipling.

intriguing as it is complicated, yet the response of insects to their environment must be better understood if we are to cope with them satisfactorily. The destructive effects that some chemicals have on parasites and predators of other insects and mites, bring to light the need for doing all we can to protect and augment the benefits derived from letting nature do the job. Ecology is basic to control and must be expanded and supported in future research programs. It becomes more evident that, for some time to come, we will have a combination effect of chemical and natural control in most field programs. We must keep an eye on the value of the natural control factors and prevent, if possible, reducing their effectiveness.

With modern transportation becoming faster and more far reaching every year, it is a safe bet that we may expect greater speeds in commodity movement in the future. As long as civilization advances, we will move food and fiber over the face of the earth and some of the insect species that attack it. It seems a necessity to develop more effective means for scouting for infestations, to determine pest risk in the movement of commodities and to have means for disinfecting cargo with a minimum loss of time and effort. Great steps have been taken already to minimize the opportunity for movement in or out of our country of pests that are of concern in public health as well as in commerce. If, on a worldwide basis, we can work toward being certain that produce destined for another port is free from infestation when it leaves, a greater

degree of protection against pest movements can be afforded than having to reject infested goods offered at a port of entry. The work of the quarantine and control officials is going to become more difficult as populations increase and travel time is shortened; their problems need careful support and attention.

One hopeful sign along the way in search of new pesticides is the attempt to develop new chemicals that will be safer to the user than some now in use. The manufacturer and consumer of pesticides want the safest possible products that will do the job in insect control. Doubtless legislation will always protect the purchaser of insecticides or the consumer of commodities treated with them. We need good fair legislation and we need to know exactly where we stand on tolerances in order that safe programs of insect control can be recommended. Close planning between research, extension, and regulatory agencies will tend to foster safe use of pesticides.

Systemic insecticides afford an interesting field of research and use. Commercial experience abroad, with use on food crops in England, Germany, and Africa, plus limited food-crop use that recently has been approved in the United States, will provide further background with this type of insecticidal compounds. These materials hold promise of destroying the pest without injuring many beneficial insects. With proper interval between application and harvest, the plants will detoxify some of the compounds and eliminate residue hazards when used on food crops. Experimental work reported by the U.S.-D.A. opened the field of research on systemic insecticides as a means of controlling some insect parasites of farm livestock. The day will come when this approach may make possible the destruction of some serious pests before they have an opportunity to do damage. Many interesting problems lie ahead in the systemic field with both plants and animals, and the help of the biochemist will be of paramount importance in learning to understand them.

The cooperative approach with a team of scientists working on many of our entomological problems promises an integrated attack on insect pests in the future.★★

AGRICULTURAL CHEMICALS

Insect Research at

State Experiment Stations

by E. R. McGouran

U.S.D.A., Office of Experiment Stations
Berkeley, California

EFFECTIVE control of insect and related pests within the State is a major aim of the research in entomology at the State experiment stations. The discovery of the basic facts and principles underlying insect life and activity is another major objective. Investigations are made of beneficial insects, such as honey bees which are valuable in pollination and honey and wax production, and parasites, predators, and diseases of insects which are utilized to control pests. Another attack on insect problems at State experiment stations is through the study of research results obtained elsewhere and their application to conditions within the State. A broad program of research is often focused on insect problems by approaching them simultaneously from a number of angles.

Insects have been of major concern to the farmers of the United States since early Colonial days. By 1880, research on insect pests and their control had been started in a few of the State agricultural experiment stations that had been established at that time. This was a few years before Congress passed the Hatch Act of 1887, which started Federal-grant support to State agricultural experiment stations. In 1889, the State agricultural experiment stations employed 29 entomologists. In 1904, after 50 years of professional entomology, the State stations employed 62 entomologists. Because farmers are always faced by potential losses from insect damage, research on insects has been expanded over the years at the State stations. Research on insect problems is now in progress at the experiment stations in all the States, Alaska, Hawaii, and Puerto Rico. A recent report shows that, at the end of 100 years of professional entomology, the State agricultural experiment stations employ approximately 475 entomologists. In addition,

there are part-time and temporary employees who assist with the research on insects at the State stations.

Research on insects at the State agricultural experiment stations is, with a very few exceptions, under the administration of the land-grant colleges. At about 60 percent of the State stations, the head of the entomology department directs the research and residence teaching on insects. At about 20 percent of the stations, he devotes his time to research alone, and at the remaining 20 percent he is in charge of research, residence teaching, and extension work in entomology. Aside from the department heads, about 66 percent of the State station entomologists devote full time to research. Approximately 33 percent are engaged in research and residence teaching, including the direction of research of graduate students, and the remaining 1 percent divide their time between research, teaching, and extension work. In about 40 percent of the States, one or more entomologists are located at substations. In one state, station entomologists make their headquarters at 7 locations, in addition to the main station.

Both the State- and Federal-grant-supported insect studies are often augmented by cooperative work between the State experiment station and the Entomology Research Branch of the Agricultural Research Service of the United States Department of Agriculture. In a number of instances, Federal entomologists are housed in the experiment station buildings. In other cases, Department laboratories are in separate buildings in the same locality as the State experiment station. Research is often jointly sponsored.

Experiment station entomologists often cooperate with plant pathologists to develop well-rounded pest control practices on crops suffering dam-

age from both insects and diseases. They also work closely with agronomists, horticulturists, chemists, animal husbandrymen, agricultural engineers, and others to insure well-rounded insect control programs for farmers in the respective States. Insecticide manufacturers cooperate with the State experiment stations in the development of better materials and in making them commercially available.

Research on insect control at the State stations is of course designed to meet the varying conditions and needs of each State, and in proportion to the extent and importance of the crops affected. In some instances, it may be impractical to control insects that do little damage or that feed on crops that have a low value per acre. In States producing large quantities of a particular crop, such as apples, the experiment station often assigns one or more of its entomologists to research that will help growers solve special apple-insect problems. In other States, where apples, for example, are only a minor crop or are grown only occasionally, apple-insect control may be only a part-time or even incidental activity. In States where dairying is a major enterprise, the research on fly control in dairy barns and on dairy cattle in pastures may be assigned to one, and sometimes more, station entomologists.

Crops that are grown in all States, such as vegetables, present different insect problems in different areas, and station entomologists are assigned to vegetable insect research for example, to solve the worst problems in the State. Research on biology, identification, physiology, and other essential phases of entomology is in progress at experiment stations and provides background information for insect control. These few examples illustrate how insect research at the State agricultural experiment stations is patterned to protect agricultural production in the respective States.

Flexibility in the entomology program at the State stations is maintained so that new problems and new needs can be studied as they arise, and control measures can be developed. By keeping in touch with conditions in the State, the station entomologists are able to direct their research to counterbalance any changes in insect activities that may occur. Intensified research is often demanded when an insect that has been a

minor pest for years gradually or suddenly increases to seriously destructive proportions. A satisfactory control is needed, and research also is required to determine why the pest increased, so that future outbreaks may be avoided.

A recent and promising development in the research on insects at the State agricultural experiment stations is the initiation of regional cooperative research supported by the Regional Research (Bankhead-Jones, Section 9(b)(3) Fund. For many years, State station entomologists have cooperated with entomologists in other States. However, it was not until 1946 that Federal grants to the State stations were authorized specifically for the support of regional research. Under the provisions of this act, State stations which have a mutual interest

in an agricultural problem, including entomology, can plan and carry out cooperative research on it. Also, the Entomology Research of the Agricultural Research Service usually participates in the cooperative regional research on insects and their control. In this manner, the cooperators are able to contribute to the phase of the problem to which they are especially suited. Often certain States have special facilities, or climatic or other conditions, that can be utilized by the group to advantage. The results of the research by the cooperators are discussed by a technical committee. As a consequence, the progress made by each is made available to the other cooperators as a basis for control recommendations and plans for further research.★★

Control of Insect Pests in Citrus

By R. L. Metcalf

University of California
Citrus Experiment Station

ENTOMOLOGICAL research on the insect pests attacking citrus crops has always been especially vigorous because of the high unit value of the crop and the large number of serious insect enemies of these exotic plants. Progress in this field and contributions to economic entomology have been summarized admirably in a recent review by A. M. Boyce (*Jour. Econ. Ent.* 43: 741, 1950).

The annual estimated value of the citrus crop in the United States is in excess of \$400,000,000 or an average yearly return of approximately \$450 for each of the 877,000 acres under cultivation. The oranges, lemons, grapefruit, and limes are attacked by some 80 species of injurious insects and mites, nearly all of which are of foreign origin. These pests injure the crop in many ways, including such subtle attacks as those of the rust mite and citrus thrips which mottle or scar the fruit and reduce its quality, the thrips and aphids which distort and deform new leaf growth, the red mite and armored scale insects which cause severe leaf drop and may

poison the tree by the injection of salivary secretions. The unarmored scales remove enormous quantities of sap from the trees and secrete large amounts of sticky honeydew which promotes the growth of sooty mold fungi, interfering severely with harvesting of the crop, while the bud mite produces grotesquely distorted fruits. Other pests such as katydids, cutworms, orangeworms, and fruit tree leaf roller cause more obvious destruction by chewing off new leaf growth, and consuming small and damaging large fruits. The most serious injury of all results from the virus diseases spread by the feeding of aphids which may destroy an entire orchard. In view of the potentialities of these insect depredations, the annual expenditure of about 3% of the value of the crop for pest control does not seem unwarranted.

The use of petroleum oil sprays for citrus pest control originated with the employment of kerosene about 1860. Since that time progress has resulted in the continual improvement of materials and formulations, lead-

ing to the development of the highly refined mineral oils, and the utilization of quick-breaking oil emulsions to increase the amount of oil deposit. Recent work has demonstrated that paraffinic oil fractions give better control of California red scale and citrus red mite eggs at 4 quarts per 100 gallons than 10 conventional oils at 7 quarts. The adverse effects of the oils on citrus fruits and foliage can be partially corrected by better timing of applications which reduces the depression in total soluble solids in the juice, and by the addition of trace amounts of 2,4-D which significantly reduces leaf and fruit drop. The overall effectiveness of oil sprays has also been improved by the incorporation of toxicants such as rotenone, DDT, and parathion.

Tent fumigation of citrus trees with hydrogen cyanide has long been a traditional practice for the control of citrus scale insects. However, the spread of resistant strains of red, black, citricola, and other scales and the increased cost of hydrogen cyanide and labor for the handling of the fumigation tents have contributed to the virtual abandonment of this practice. Many organic compounds of suitable boiling point have been investigated as possible fumigants, but to date no promising materials have been discovered.

Fumigation has, therefore been largely replaced by the employment of the newer organic insecticides. DDT-kerosene sprays initially showed much promise for the control of immature stages of citrus scale insects, but their usage has been discouraged in many situations because of the unfavorable effects on populations of beneficial insects. DDT and the related DDD are now used largely for the emergency control of orangeworms, fruit tree leaf roller, cutworms, and other caterpillars. Parathion sprays have proved outstanding for the control of all the species of armored and unarmored scales except soft scale, and it is estimated that this material is annually applied to more than half of the citrus acreage of California. In some areas over 90% of the groves are treated and the degree of control has been so satisfactory that seasonal treatments are no longer imperative.

The large scale employment of a hazardous material such as parathion has created unprecedented demands

(Turn to Page 107)

AGRICULTURAL CHEMICALS



NAC

to hold 21st annual
meeting Sept. 8-10
at Spring Lake, N. J.

THE 21st annual meeting of the National Agricultural Chemicals Association will be held September 8, 9, 10, 1954, at Spring Lake, New Jersey. Headquarters for the meeting as usual will be the Essex and Sussex with accommodations also available at the nearby Monmouth.

A tentative program for the meeting follows. Richard Yates, Hercules Powder Co., Wilmington, is in charge of the committee arranging the program.

Wednesday, Sept. 8

Where We Stand Today — and Tomorrow

10:10 A.M.

President's Address

Paul Mayfield

Hercules Powder Co.

10:40 A.M.

Executive Secretary's Report

Lea S. Hitchner

Executive Secretary, N.A.C.A.

11:00 A.M.

Relationship of Pesticides to Health

David E. Price, M.D.

U. S. Public Health Service

11:40 A.M.

Telling Your Story

6:30 P.M.

Reception, Ballroom

8:00 P.M.

Board of Directors Meeting

Thursday, Sept. 9

How to Operate Under the Pesticide Residue Amendment (Miller Bill)

10:00 A.M.

Panel Discussion

Effects of the Miller Pesticide Amendment on the operations of the Industry, Government Agencies, Farmers, Land Grant Colleges and others

Annual Golf Tournament

Time and Place to be Announced

7:00 P.M.

Annual Banquet

Friday, Sept. 10

Up-to-date Information for the Success of the Industry

Presiding Officer

W. W. Allen

Dow Chemical Co.

Midland, Michigan

10:00 A.M.

Using Miracle Drugs In Agriculture

Henry Welch

U. S. Department of Agriculture Washington, D. C.

John C. Dunegan

U. S. Department of Agriculture Beltsville, Maryland

10:30 A.M.

Will Your Organization Wear Well?

W. R. Dixon

Dow Chemical Co.

Midland, Michigan

11:00 A.M.
Are You Short Changing Yourself?

John F. Adams

Temple University Philadelphia

11:30 A.M.

What Do You Know About Your No. 1 Customer — The Farmer?

E. H. Fallon

Ccooperative G.L.F. Exchange, Inc. Ithaca, N. Y.

Committee Meetings will be Announced.

Also on the program is a report on the public relations aspect of the pesticide industry, by Frank H. Jeter, North Carolina State College.

R. YATES, program chairman



California

FERTILIZER ASSOCIATION

TWO previous issues of *Agricultural Chemicals* reported the commercial fertilizer mixing industry of the great San Joaquin, Sacramento, Salinas and Santa Clara Valleys of California. This final article in the series covers Riverside, Imperial and San Diego Counties, and the outlying portions of Los Angeles County.

Terra Food Fertilizer Co., El Monte, was formed in 1949. Donald Slattery, president, came to California in 1947 and with two associates purchased the Highland Park Herald. This was a successful venture and was sold profitably in 1948. He manufactures a completely water soluble, high analysis dry fertilizer in approximately 10 standard mixtures. It is marketed in Santa Barbara, Ventura and Santa Clara Counties, as well as in the entire San Joaquin Valley under the "Terra Food" brand. The plant is equipped with a Stedmann mixer of about 50 tons per day capacity.

Situated in a large, lemon grove in East Whittier is the plant of the Leffingwell Chemical Co. The property, which originally comprised 500 acres, was purchased in 1888 by Dr. C. W. Leffingwell. In 1893, Dr. Leffingwell's son, C. W. Leffingwell, Jr., was placed in charge of the property with instructions to develop the lemon acreage which he did successfully. He started the first commercial soil laboratory in California on the ranch. In 1916 Dr. I. G. McBeth, formerly with the United States Department of Agriculture and more recently with the Riverside Experiment Station, was employed as manager of the property. He and a group of employees organized a corporation and purchased certain acreage of the

Leffingwell Rancho, and later acquired the remaining Leffingwell interests.

Dr. McBeth, meanwhile, had developed and was manufacturing for his own ranch use pest control materials, which were soon in demand by neighboring growers. This growing demand resulted in the development by the Leffingwell Rancho Co. in 1925 of a commercial plant for production of insecticides and fungicides. Fertilizers and minor element sprays followed in the early 30's and the business soon became one of the leading ones of its kind on the Pacific Coast.

The concern has expanded until today its production facilities are housed in several large buildings. The dry fertilizer mixing plant consists of two one-ton mixers in tandem, with a capacity of 25 tons per day. The plant was custom built. Dry mixed fertilizers are distributed throughout the area under the "Vita-tone" brand name. Officials include Frances A. Black, president; J. V. Ryland, executive vice president; Joseph W. Kinsman, purchasing agent, and J. R. Allison, director of research.

Kellogg Supply Co., Wilmington, was founded in 1926 by H. Clay Kellogg. The initial business centered around the sale to growers of sewage sludge purchased from city and county sewage treatment plants. Kellogg did much to promote the acceptance and use of this material as a valuable crop production aid, and sewage sludge is now an important material in the California industry. The firm developed equipment for delivery and on-the-farm spreading of sludge, which has met with enthusiastic farmer acceptance. The material is marketed under the trade name "Nitrohumus".

Part IV

By Sidney H. Biorly

Secretary
California Fertilizer Association

Research and development work is going forward in the field of scientifically blending organic materials in the preparation of composts for mulching purposes, under the trade name "Vita-Mulch".

Mixed fertilizers are formulated and sold under the brand names "Kellogg's Nitrohumus Fertilizers" and "Kellogg's Nitrohumus Minerals". Two large manufacturing units are operated in Wilmington, consisting of a specially designed bulk unit of 400 ton-per-day capacity, and a mixing and bagging plant with a 200-ton daily capacity. Another plant, in Los Angeles, is operated as the Globe Fertilizer Division of Kellogg Supply Co., under the management of Rowland E. Myers. Here is processed and bagged steer manure, leaf mold, peat moss, "Vita-Mulch" and small packaged mixed fertilizers and other materials for the nursery trade. Plant capacity is 500 bags per hour. Other branch offices are located in Garden Grove and in the Coachella Valley, both in California.

Tom A. Barnard, owner of the Growers Chemical Supply started operations in 1946. The first shipment of mixed fertilizer was made in December of that year. He has recently installed a new 70 ton per day capacity Stedmann dry mixing plant, equipped with a St. Regis valve bag packer. There are bins for storage of 200 tons of bulk materials, and additional area for bagged material storage. Both rail and trucks serve the plant. His "Silver Bow" brand mixed

fertilizers are marketed in Los Angeles, Ventura, Orange, Riverside, San Bernardino, Imperial and San Diego Counties.

Soluble Plant Nutrients Co., Azusa, was established by J. E. Johnson in 1944. Soluble maintains two liquid mixing plants, at Westmoreland, Imperial County, California, and Augusta, Kansas, marketing under the "Green Acres" brand, and sells dry simple fertilizer materials as well, in California, Arizona, Colorado, Kansas, Nebraska and Missouri.

Howard H. Hawkins, is vice president and manager of the Golden State Plant Food Co., Glendora. His associates in the business are H. M. Sperber, president, and E. B. Chewning, secretary-treasurer. A custom built dry mixing plant of 25 tons per day capacity turns out "Golden State" brand mixtures which are distributed in seven southern California counties. The plant, surrounded by orange groves, is served both by rail and truck. Hawkins is a director of the California Fertilizer Association.

At Riverside there are two mixer-members of California Fertilizer Association. Karl Ahlsweide, whose liquid mixing plant is located in Arlington, a suburb to the southeast of Riverside established his business there in 1942, and engages in the mixing and distribution of liquid mixtures and dry simple fertilizers. The firm serves farmers of Riverside, San Bernardino and Los Angeles Counties. There is a 2000 gallon redwood mixing tank and a portable mechanical agitator. The plant is served by rail and truck. Ahlsweide also distributes a line of pesticides.

The Riverside Fertilizer Works, Riverside, is managed by Pem W. Waugh, who took over in 1948 from J. M. Webster, who started the business in 1939. The plant served both by rail and truck, features a Link-Belt dry mixing unit of 25 tons per day capacity. There are bulk material storage facilities. In addition to "R.F.W." brand mixed fertilizers, Waugh's concern deals in simples, agricultural minerals, and a complete insecticide line in Riverside and San Bernardino counties.

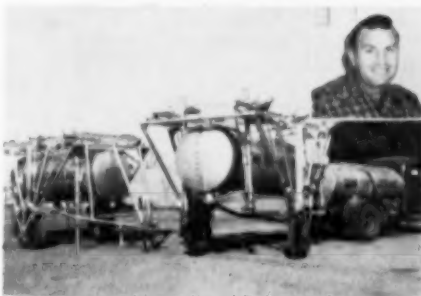
Golden State Plant Food Co., Glendora, California. Insert: Howard H. Hawkins, vice-president.



Ahlsweide Fertilizer Co., Arlington, Calif. Insert: Karl Ahlsweide, owner.



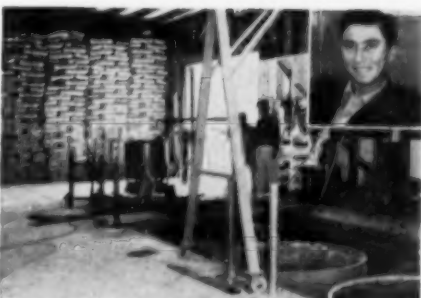
Mobile tank units of Tank Fertilizers, Inc., Brawley, Calif. Insert: H. F. Schreck, manager.



Growers Chemical Supply Co., Azusa, California. Insert: Thomas A. Barnard, owner.

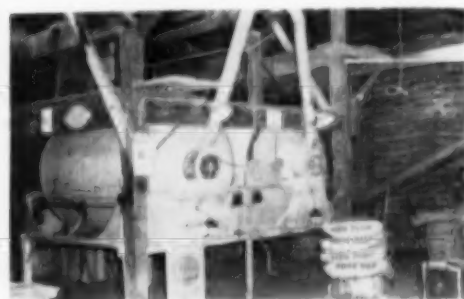


Liquid mixing plant of the Border Fertilizer & Supply Co., El Centro, Calif. Insert: B. J. Cannon, general manager.





Photos at left, reading from top to bottom: Dry mixing plant of Riverside Fertilizer Works, Riverside, Calif.; Lime-sulfur plant of Imperial Fertilizer & Sulfur Co., Calexico, Calif.; Mixing plant of Lettingwell Chemical Co., Whittier, Calif.; Insecticide mill of Arizona Fertilizers, Inc., Phoenix; and the Wilbur Ellis Co., Chula Vista, Calif.



Tank Fertilizer, Inc., Brawley, is managed by Henry Schreck. In 1942 W. F. Aycock, now vice president and treasurer, was among the early contributors to the idea that nitrogen solution could well be applied to the crop lands of Imperial Valley in the irrigation water, and, with R. B. Wilson, now president, he organized the Tank Fertilizer Co., which was incorporated in 1948. Liquid ammonium nitrate is delivered to storage tanks by rail car, and dry ammonium nitrate is placed in solution at the plant. This material is delivered to the fields of farmer customers in mobile tanks of 1000 gallon capacity. The brand "T.F.C." is well known throughout the Imperial Valley.

The Border Fertilizer and Supply Co. was founded in 1948 under the name Benedict Fertilizer and Supply Co., with two of the same officers who currently run the business. They are Earl E. Nielsen, president, and B. J. Cannon, general manager. Charles Bartholomew, vice president, entered the concern in 1951. They manufacture liquid mixed fertilizers, which are sold throughout the Imperial Valley under the "B" brand. Border has recently taken the agency for a 20% aqua ammonia, which it injects direct to the field. A dry mixing plant is operated to fill specific farmer orders. A full line of pesticides is sold in the area.

The Imperial Fertilizer and Sulfur Co., Calexico, on the Mexican border is operated by Theodore Meyers. This plant is equipped to provide complete lines of dry mixed fertilizer, soil sulfur products, and dusting sulfur bases. The concern was organized in 1950 by Mrs. Meyers, then Mary L. Vramak. Ted Meyers came into business in 1951.

Their "Vesubio" brand of fertilizers is well known throughout the Imperial Valley. Soil sulfurs sold under the same brand name are shipped into the entire San Joaquin Valley, the Salinas Valley, and into Arizona. Balfour Guthrie & Co., Ltd., are exclusive distributors of "Vesubio Brand 50% Soil Sulfur". Imperial also custom mixes products for other concerns.

A new development is under way on the premises, which is completely separated from the business of Imperial. That is a liquid plant food materials plant in which Mary Meyers and D. W. Bradbury are partners. Now in operation is a new liquid lime sulfur plant. Impurities are filtered out carefully, insuring a high grade product. Existing storage capacity is 40,000 gallons. Established liquid dealers in the Imperial Valley and Yuma Valley are taking the entire plant output.

General Fertilizer and Supply Co., Chula Vista, began originally as a co-partnership. The company was incorporated in 1946. It has from its inception distributed commercial fertilizer in the southern area of San Diego County. In 1948 a boiler and vats were installed for the manufacture of liquid fertilizer. In 1949 a one-ton dry drum mixer was installed for mixing soluble concentrates. In 1950 a Poulsen dust blending machine was added, which rounds out the business with a line of pesticides. In early 1953, the new plant at Otay was completed and equipped for an annual output capacity of 100,000 gallons of liquid fertilizer, 5000 tons of dry mixed fertilizer, and 2000 tons of insecticides. Brand names are "General" fertilizers and "National" for pesticides. In addition, two lines of seeds are handled. The area served

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is San Diego County and Baja California, Mexico. J. N. Williams is president, and R. K. Williams, Jr. is secretary-treasurer.

Wilbur-Ellis Company's plant at Chula Vista, is located on the San Diego and Arizona Eastern Railroad in the southwest part of town. Managed by Fred Nason, it serves San Diego County with complete lines of fertilizers (both for farm and nursery), insecticides and seeds. The entire output of sewage sludge of the city of San Diego is marketed. The plant is new and modern. Wilbur-Ellis fertilizer headquarters are located in Los Angeles. This operation was reported in the 1952 article.

Two mixer members of California Fertilizer Association in Phoenix, Arizona include Arizona Fertilizers, Inc., and Capital Feed & Seed Co.

Frank M. Feffer, Sr., is president of Arizona Fertilizer, M. F. Wharton, Sr., secretary-treasurer; Frank Feffer, Jr., vice president, and Mack Wharton, Jr., assistant secretary-treasurer. It is interesting to note that in 1938, the first year in which fertilizer tonnage figures became available, Arizona farmers used only 8626 tons. In 1952 the figure was 109,234 tons!

In 1929, the late J. A. Feffer, father of Frank Sr., settled in Phoenix. He purchased a half interest in a struggling young fertilizer concern doing business as the Arizona Natural Products Co. Its equipment consisted of an old ore mill, discarded by a nearby mine. Feffer soon purchased complete control and in 1935 his son Frank joined him. This marked the beginning of a modernization and expansion program, still going forward on a sound basis today.

The firm was renamed Arizona Fertilizers, Inc., in 1937, and Malcolm F. Wharton, Sr., who had been associate professor of horticulture at Univ. of Arizona became head of the new research department. He still holds this post, and in addition, is now in charge of the experimental department and of formulations and manufacturing. The concern moved to its present location in 1940.

Two fertilizer mixing plants are in operation, with a capacity of 75,

Arizona Fertilizers, Inc., Phoenix, left to right: M. Wharton, Sr., M. Wharton, Jr., F. M. Feffer, Sr., F. M. Feffer, Jr., and T. Swift. Photo second from top: Mary and Ted Meyers, Imperial Fertilizer & Sulfur Co., Calexico, Calif.



000 tons, and the firm's "Nature's Gift" brand mixtures are distributed throughout Arizona and in portions of Utah, Mexico and California. The Phoenix plant is located on a 2½ acre site, and consists of fertilizer and insecticide manufacturing plants and warehouse facilities. It is served by both rail and truck. A new pesticide plant was opened in 1953 at Toltec. These materials are marketed under the brand name "Phoenix". Branches are located at Buckeye, Casa Grande, Coolidge, Parker, Safford, Tucson and Yuma, Arizona and at Blythe, California.

The Capital Feed and Seed Co. was opened for business in 1920, dealing principally in fuel at that time. A short time later, the business had developed in such a manner that feeds, seed, fertilizers and insecticides became its specialty. Herbert Stein is president, Morton S. Kleinberg is vice president and James E. Wolf is secretary-treasurer. Branches are maintained in Gilbert and Coolidge, Arizona, with a feed mill located at

(Continued on Page 109)



Photos: third from top: D. J. Slattery, president of Terra Food Fertilizer Co., El Monte; fourth from top: J. E. Johnson, owner of the Soluble Plant Nutrients Co., Azusa, Calif.; at right: F. Nelson and W. E. Snyder of Wilbur-Ellis Co., Chula Vista, Calif.



New Sugar Base Pesticide Sticker Developed

THREE years of laboratory and field tests on a new sugar-base sticker for use in field application of pesticides have just been completed at the University of Delaware, and the results of the work summarized with publication of a booklet detailing the work. The investigation proceeded under a research fellowship established by the National Sugar Refining Company of New York, under the general supervision of Dr. L. A. Stearns, chairman of the Department of Entomology at University of Delaware, with Dale F. Bray being responsible for the major part of the research.

The product developed as a result of the research is called "National Sticker." It is a dark solution of a number of resins in methanol. Although insoluble in water, it is soluble in numerous organic solvents. Under test it was found to be compatible with many spray chemicals and with certain herbicides and nutrient materials. It caused no serious spraying troubles in any of the sprayer types in which it was tested.

It was found to improve deposits of pesticides applied as sprays, and to reduce the usual losses in residues resulting from weathering. In tests for production and retention of residues, it proved superior to several well-known and widely used commercial stickers. It was evaluated for use on beans, broccoli, cabbage, corn, cucumber, potatoes, tomatoes, apples and peaches, with significant gains being reported in degree of pest control obtained and/or quality and size of harvested crop. In some cases it was reported that use of this new sticker made possible a substantial decrease in the number of applications required for effective results. Its addition to the formulation of fly sprays for use on dairy cows and in dairy barns is reported to have resulted in increased kill and prolonged residual effect of treatments.

The accompanying tables show materials, crops and methods of application compatible with National Sticker, and a comparison of the product with three commercial ma-

terials indicating improved retention with National Sticker.

As the product is derived from sugar, it was thought that it might (Turn to Page 103)

Materials, Crops, and Methods of Application Compatible with National Sticker¹

Material	Crop and Method of Application ²
Insecticide	
Aldrin	Potatoes 1 (D. O. Wolfenbarger).
BHC	Apples 1, 2; Peaches 1, 2.
Calcium Arsenate	Tomatoes 1; Cabbage 1.
DDT	Apples 1, 2; Broccoli 1; Corn 1 (D. O. Wolfenbarger); Dairy Barn 1 (R. Hutson); Gladiolus 1 (E. G. Kelsheimer); Grapes 1 (G. W. Still); Peaches 1, 2; Potatoes 1; Roses (J. B. Polivka); Tomatoes 1.
DDD	Apples 1, 2; Tomatoes 1, 3.
Dieldrin	Peaches 1.
Dilan	Apples 1 (C. Graham).
EPN 300	Apples 1 (L. O. Weaver); Peaches 1.
Lead Arsenate	Apples 1, 2; Tomatoes 6.
Lindane	Alfalfa 3; Broccoli 1; Clover 3.
plus Arasan S. F.	Beans 4; Corn 4.
plus Methoxychlor	Dairy Barn 1.
Magnesium Arsenate	Beans 7.
Malathion	Apples 1 (C. Graham).
Methoxychlor	Alfalfa 3; Broccoli 1; Cucumbers 1, 3; Dairy Barn 1.
Nicotine Sulfate	Apples 1 (L. O. Weaver); Tomatoes 3.
Parathion	Apples 1, 2; Broccoli 1; Guava 1, 5 (L. F. Steiner); Peaches 1, 2; Tomatoes 1.
Rotenone	Beans 1.
Ryania	Corn 7.
Sulphenone	Citrus 1 (W. L. Thompson); Pears 1 (N. E. Hardman).
TEPP	Broccoli 1 (E. L. Wisk).
Toxaphene	Alfalfa 1; Clover 3.
Fungicide	
Arasan S. F.	Beans 4; Corn 4.
plus Lindane	Apples 1, 2.
Bordeaux (4-4-100)	Apples 1, 2; Celery 1 (G. Swank, Jr.).
Ferham	Tomatoes, 4 (J. D. Wilson).
Manzate	Cucumbers 1, 3; Potatoes 1.
Nabam	Apples 2 (A. B. Groves).
Orthocide 406	
Sulfur	Apples 1, 2.
Flotation	Apples 1, 2; Peaches 1, 2.
Magnetic 70	Citrus 1 (W. L. Thompson).
Wetttable	Apples 1 (L. O. Weaver).
TAG	Potatoes 4; Tomatoes 4 (J. D. Wilson).
Tribasic	Peaches 1.
Zinc Sulfate-Lime	Cucumbers 1; Potatoes 1; Tomatoes 1.
Zineb	Celery 1 (G. Swank, Jr.).
Ziram	
Miscellaneous	
Fertilizers	Apples 1 (R. W. Dean); Beans 4; Corn 4.
Polyhedral Bodies (Virus)	Pine (for Pine Sawfly) 8 (J. M. Cameron)
Weed Killers (2, 4-D 2, 4, 5-T)	Weeds 1 (D. J. Crowley).

¹Where this sticker was tested other than at the University of Delaware, the name of the cooperating investigator is given in parentheses.

²Methods of application are: (1) Hydraulic sprayer, (2) Speed sprayer, (3) Low-gallage sprayer, (4) Seed treatment, (5) Bait, (6) Dip, (7) Hand sprayer, and (8) Air.



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WASHINGTON *Report*

by
Donald G. Lerch

Cornwell, Inc., Washington, D. C.
(Agricultural Chemicals Washington Correspondent)

FOR those concerned with the new pesticide law, it's only the beginning. The regulation, which actually amends the Food and Drug Act, sets up new working relationships and in some respects is a new deal in the matter of protection of public health and limitation of residues. The USDA serves in a stronger capacity.

George P. Larrick, deputy commissioner of the Food and Drug Administration feels it is significant that the measure is both approved and endorsed in practically all aspects by the industry to be regulated. He also feels that while there are new procedures to be established under terms of the law, many of the existing working relationships will be continued and in effect strengthened. Members of his staff are getting together plans for fees, advisory committees, and other items called for in the law. Larrick considers the time spent on the previous residue tolerance hearings as "not wasted." In addition, he expects there will be a number of conferences called with industry.

Lea S. Hitchner, executive secretary of the National Agricultural Chemicals Association hopes that the tolerances which have been delayed so long can now be issued. These are the tolerances for which hearings were held four years ago with over 10,000 pages of testimony and hundreds of exhibits.

It has been known for some time that the work involved in setting

tolerances has been completed for some time. On several occasions it has been reported the documents were "sitting" on the Secretary's desk where they have apparently been gathering dust. There have been strong indications that the hearings before Congress were closely tied with the residue tolerance proceedings. If this indeed is the case, then the tolerances may be coming out momentarily.

This new law clearly gives the Secretary of Agriculture two major responsibilities. One is to determine the usefulness of a pesticide chemical in agriculture. The second is to give his opinion as to whether a proposed tolerance or exemption reasonably reflects the residue which is likely to result when the pesticide chemical is used as proposed. In this respect, the law states that generally recognized and accepted good agricultural practices which normally eliminate or minimize residues may be taken into account in establishing tolerances. The law reserves for the Secretary of Health, Education, and Welfare the function of determining safe residues from the standpoint of the consumer.

Those who testified at the residue tolerance hearings will appreciate the few extra paragraphs which are a part of the new law. They refer to "usefulness." All kinds of interpretation have been put on the word. It is a key part of the law. Many meetings were held before the following carefully chosen words were ac-

cepted, "Usefulness of a pesticide chemical for the purpose of certification under H.R. 7125 should be determined upon the basis of its practical biological or pesticidal effectiveness. Pesticidal effectiveness may be established in terms of percentage reduction or control of pests or, when appropriate, increase in yield or quality of crop or other economic gain or practical benefit following application of the specified pesticide under the conditions prescribed, compared with results from adequate controls. . . . Thus, when the petitioner submits data showing that a pesticide chemical is effective against one or more pests common to fresh fruits, if the petitioner so requests, the chemical should be certified as useful on fresh fruits for the purpose of establishing a tolerance thereon even though it has not been tested on all fresh fruits, providing the data reasonably indicate that it will be effective on a wide variety of fresh fruits."

This will relieve much of the burden of going over and over the same ground when it comes to proving necessity for use. It should save company men time and money. It makes it possible to get down to the real problem without all the fuss about how bugs live and how chemicals kill them. All this is fine for the College classroom, but it is hardly the thing for adults who are supposed to be seeking to protect the public health.

* * * *

W. G. Reed, head of the Pesticide Regulation Section of the USDA is making plans for handling most of the work under the new law which is done in the name of the Secretary. At present, Reed is charged with the administration of the 1947 Federal Insecticide Act.

He believes it likely that the services of several research arms of the Department will be drawn on to make the various findings called for. In as much as the Department is still attempting to get settled after the big reorganization of a few months ago, Reed's problem will be to find the people he needs to consult with and then determine the

AGRICULTURAL CHEMICALS

lines of communication. In Government this is never easy.

* * * *

A story originating in the office of the Secretary of Agriculture attracted considerable attention this past month, necessitating a series of clarifying statements, after the original item created mild consternation with an unfortunate reference to "planned farming." What really happened, the way we heard it, was that the USDA asked for an added appropriation to enable it to hire 1,000 new assistant county agents. The idea was to use these new men to relieve some of the older employees of part of their detail work and to permit more face to face contact with farmers.

A writer for a usually highly accurate New York daily got hold of the story, let his imagination run on a bit, and came up with a new USDA program for "planned farming" which apparently existed principally in his mind. As he visualized the new program, the USDA was going to help American farmers "achieve efficient production, higher net income, improvement of soil productivity, and better living conditions for the entire farm family" by a program of advice which was to include counsel on what and how much fertilizer to use, how to employ insecticides most efficiently, etc.

Our agents advise us that following appearance of the story, with its references to "master plan," "planned farming," etc., there were loud screams from various directions and Secretary Benson spent considerable time on the phone trying to clarify the picture. More on the actual meaning of the new program next month.

* * * *

The Foreign Operations Administration is inviting South American countries to send representatives to the United States for a farm newspaper and farm radio meeting which will run through the fall and into the winter. Purpose is to familiarize Latin American farm editors and farm broadcasters with agricultural information methods used in this

country. Those attending will spend part of their time in Washington, then will work with editors and broadcasters in the U. S.

There may be several opportunities for the fertilizer and pesticide industries to meet with these men while they are here. An exchange of information between parties could well open opportunities for both. With a growing interest in foreign trade, this meeting seems to be well timed.

Turkey, El Salvador, and the Dominican Republic are three of the leading countries which want U. S. business to invest its money for the construction of agricultural chemical plants, according to studies made by the Foreign Operations Administration. What's more, these countries have said they will play ball with the right people if they move in.

This is but a part of the huge move to export American money as well as goods. Some of our business leaders have concluded that there is a probable ceiling on the amount of goods we can export in view of our trade policies. Shortages of dollars still exist and we continue to threaten to embargo imports of both agricultural and manufactured goods. Clarence Randall himself helped

make some of these studies by making a special overseas trip for this express purpose.

Without question this is one of the top subjects in many companies. Mail and phone calls to Washington on this subject show it. There may be tremendous opportunities for profit and you can expect the government to give you free rein to find them. They might even point to the areas where you will find the best hunting.

In the final analysis however, profits can't be expected unless risks are involved. The only way these decisions can be made is by the individual management of respective companies.

Therefore, we strongly advise that you come down yourself, if interested, and spend a day or two getting your sights set. You certainly can't get much of the story by letter and not much better satisfaction by phone. In most cases it is going to take your personal attention.

You can be sure however, that the government is paying more than lip service to the matter of opening the doors for business men to expand their operations overseas. This might be a good bet.★★

Miller Bill Gets Eisenhower Signature

Washington, D. C., July 22 . . . The Miller pesticides bill, H.R. 7125 was signed into law by President Eisenhower. The new amendment to the Federal Food, Drug and Cosmetic Act provides for effective methods for controlling the amount of residues of insecticides and other pest control chemicals which may be left on raw agricultural products.

Prior to passage of the bill the Senate added an amendment which provides that where requests are made by manufacturers of pesticides for approval as to residual deposits, fees will be paid by the applicant. There had previously been no fee provision in the bill.

Passage of the bill through both Houses climaxes about four years of effort by the pesticide industry to draw up a control law which would provide adequate protection to the public against excessive amounts of toxic insecticides and still be acceptable to industry. Upon being signed into law, certain provisions become effective immediately, while the others are delayed for a year or more. "Tolerances for insecticides will be set by the Food and Drug Agency of the Department of Health, Education and Welfare; however the responsibility for establishing tolerances that will be safe rests with the manufacturers."

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LISTENING Post

Laboratory Tests For Screening Fungicide Chemicals

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller



J. B. Kendrick, Jr., and John T. Middleton of the University of California remark that many of the newly developed chemical materials showing promise as fungicides are recommended on the basis of their performance in laboratory spore germination tests against standard fungus species such as *Sclerotinia fructicola*, *Alternaria oleracea*, *Glomerella cingulata*, and others. Spore germination tests often indicate potentially effective materials but do not provide enough specific information concerning their scope of effectiveness when placed in soil. Laboratory tests must be devised to screen chemicals adequately before field tests are made and most investigators concerned with chemical control of soil-borne fungi have developed their own screening tests for the specific organisms with which they are dealing.

In a study designed to test the fungicides listed in Table 1 against a wide variety of soil-borne pathogens, and against some citrus and tomato fruit pathogens, eight root rotting fungi were used: *Fusarium solani* f. *Phaseoli*, *Pythium aphanidermatum*, *P. ultimum*, *Phytophthora citrophthora*, *P. cinnamomi*, *Rhizoctonia solani*, *Sclerotinia sclerotiorum*, and *Sclerotium rolfsii*. Two

organisms causing vascular wilt in tomato were tested: *Fusarium oxysporum* f. *lycopersici* and *Verticilli-*

um albo-atrum. The fruit pathogens tested were: *Alternaria solani*, *Botrytis cinerea*, *Fusarium roseum*, *Pleospora lycopersici*, and *Penicillium digitatum*.

The tests were conducted in two steps. First the fungicidal (fungus killing) and fungistatic (growth inhibiting) levels of the materials were determined at concentrations of 10, 100, and 1000 parts per million (p.p.m.) by weight of the active ingredient in potato dextrose agar. Then the more promising materials were tested with Zentmyer's soil drench test against all or selected representatives of the root rot and wilt organisms. In the first step, disks 5mm. in diameter cut from the margins of an actively growing fungus culture were placed with the fungus surface downward on potato dextrose agar plates containing the suspended chemical at one of the given concentrations. Three plates, each containing four inoculations, were

Table 1.
Materials Used, Their Chemical Composition, and Name of Supplier

Material	Chemical Composition	Supplier
captan	N-trichloromethylthio tetrahydrophthalimide	Calif. Spray Chemical Corp.
nabam	disodium ethylene bisdithiocarbamate	Rohm & Haas Co.
thiram	tetramethyl thiuramdisulfide	DuPont Company
Vancide 51W	sodium salts of dimethyl dithiocarbamic acid and 2-mercaptobenzothiazole	R. T. Vanderbilt Company, Inc.
Vancide ZW	zinc salts of dimethyl dithiocarbamic acid and 2-mercaptobenzothiazole	R. T. Vanderbilt Company, Inc.
16030	—	FarbenFabriken Bayer
856	—	Carbide & Carbon Chemical Corp.
974	3,5-dimethyl-tetrahydro-1,3,5-2H-thiadiazine-2-thione	Carbide & Carbon Chemical Corp.
275	pentachloronitrobenzene	Mathieson Chemical Company
1194	chlorinated nitrobenzene	Mathieson Chemical Company
1197	chlorinated nitrobenzene	Mathieson Chemical Company
N-521	3,5-dimethyl-tetrahydro-1,3,5-2H-thiadiazine-2-thione	Stauffer Chemical Company

used for each concentration and each fungus species. Records were taken on a given species when the radial mycelial growth reached a maximum in control plates. Fungistatic concentrations were noted where growth occurred only on the inoculum piece and radial growth was completely inhibited. In the drench test disks 5mm. in diameter were cut from an actively growing mother culture and placed on top of 10 grams of sterile soil in a small glass vial. An additional 10 grams of the same soil was added to cover the inoculum. Test materials were prepared in concentrations of 10, 100, and 1000 p.p.m. of the active ingredient by weight in water suspensions. Five milliliters of the prepared chemical suspensions were added to the soil containing the inoculum. This amount of liquid was sufficient to completely wet the entire soil column. The inoculum was retrieved at the end of a 24-hour incubation at room temperature (approximately 24°

C), and placed on potato dextrose agar plates. The effectiveness of treatment was determined after the control inoculum blocks showed growth.

The results, summarized in Table 2, show that fungicidal or fungistatic concentrations for most materials vary depending upon which fungus was used as the test organism. Mathieson compounds 1194 and 1197, inhibiting fungus growth at 10 p.p.m., were the most consistently effective compounds in agar plate tests against a variety of fungi. Mathieson compound 275 was equally effective against *Rhizoctonia solani*, *Sclerotinia sclerotiorum*, and *Pleospora lycopersici*, but was rather ineffective against other fungi in the test. The effectiveness of these compounds was either lost completely or greatly reduced when tested in the soil screen against the same fungi.

Bayer compound 16030 was almost as effective in the agar plate test as Mathieson compounds 1194

and 1197. However, it failed to show up well in the soil drenching test against *Rhizoctonia solani* and *Sclerotinia sclerotiorum*.

Stauffer compound N-521 was consistently effective at 100 ppm concentration against all the organisms tested except *Penicillium digitatum* in both the agar plate and soil testing screens.

Vancide 51W and ZW, nabam, captan, and thiram showed considerable variability in fungistatic and fungicidal concentrations against the organisms tested in the agar plate test. Only nabam exhibited any consistent fungicidal properties in the soil screen. It was fungicidal at 1000 p.p.m. concentration against nearly all of the test fungi.

Compounds 856 and 974 did not show sufficient effectiveness in the agar plate screen to warrant additional testing in the soil screen. This response was somewhat unexpected with compound 974 since chemically it is the same as compound N-521.

Table 2.
Results of Fungicide Toxicity Tests Showing the Most Effective
Concentration of Active Ingredient in P.P.M.

Organism	Materials																	
	16030		Captan		856		974		Nabam		275		1194		1197		N-521	
	P	S*	P	S	P	S	P	S	P	S	P	S	P	S	P	S	P	S
<i>Fusarium solani</i>																		
f. phaseoli	x ^{oo}		m		O		M		M	M	O	O	x		x	C	C	
<i>Pythium</i>																		
aphanodermatum	x		m	O	O		C		C	M	O	O	x		x		C	C
<i>P. ultimum</i>	x		M		O				C	M	m	O			x	M	C	C
<i>Phytophthora</i>																		
citrophthora					M				C	M		O			M	C	C	
<i>P. cinnamomi</i>									c	M		O					C	C
<i>Rhizoctonia solani</i>	c	O	c	O	O		M		M	M	x	O	x	O	x	C	C	C
<i>Sclerotinia</i>																		
sclerotiorum	c	O	c	O	O		c		x	M	x	O	x		M	C	C	C
<i>Sclerotium rolfsii</i>	x		c	O	O				x	M	c	O			x	C	C	M
<i>Fusarium oxysporum</i>																		
f. lycopersici			c	O	O				C	M	O	O		O	x	M	c	C
<i>Verticillium</i>																		
albo-atrum	c		m	O	O		M		C	M	c	O	x		x	M	C	C
<i>Alternaria solani</i>			m		O				m	M	m	O	x		x		C	C
<i>Botrytis cinerea</i>			M		O				M	M		O	X		x		C	c
<i>Fusarium roseum</i>			m		O				m	M	O	O					C	C
<i>Pleospora lycopersici</i>			c		O		c		O	M	x	O	x		x		c	C
<i>Penicillium digitatum</i>									O		O						M	M

*P = agar plate test S = soil drench test

^{oo}Capital letters = fungicidal concentration, small letters = fungistatic concentration, O = no growth suppression, x or X = 10 p.p.m. concentration, c or C = 100 p.p.m. and m or M = 1000 p.p.m.

The physical appearance of 974 was different than N-521. Different formulations of these two chemicals could possibly explain their variation in the tests.

Stauffer compound N-521 was the most outstanding of the 12 materials tested in this series of tests, showing fungicidal properties at 100 p.p.m. concentration against a wide variety of organisms in both the agar plate and soil screens. Compound 1197 showed more effectiveness in agar plate tests than N-521; however, it was less effective when applied to the soil as a water drench. Since only compounds able to move through the soil in a water phase will pass this soil test satisfactorily, it is not surprising to find discrepancies between effective concentrations of compounds tested in agar plates and soil drenches. The fungicidal principle of compound N-521 is apparently able to move through the soil in water.

The two water-soluble materials nabam and Vancide 51W were consistently effective in soil against a wide variety of fungi but only at 1000 p.p.m. concentration. None of the other compounds appears to offer any promise as a soil fungicide when applied to soil as a water drench.

It is of interest to note the specific effectiveness of compound 275 against two important soil inhabiting organisms, *Rhizoctonia solani* and *Sclerotinia sclerotiorum*. The material apparently acted against these two organisms as a fungistat but not as a fungicide at 10 p.p.m. It was not effective against two other important groups of soil inhabiting fungi, namely *Pythium* spp. and *Fusarium* spp. The soil drenching screen showed that this compound would not move in a soil solution and, therefore, would probably be effective against *Rhizoctonia solani* and *Sclerotinia sclerotiorum* only if mixed in the soil.

The use of these two types of screens against a wide variety of organisms reveals several facts of interest concerning these chemical materials. First, most of the chemicals

do not perform in a similar manner against different types of fungi. Only Stauffer's N-521 and Mathieson's 1194 and 1197 were consistent in this respect. Secondly, concentrations of some materials that are effective in preventing fungus growth in agar plates are not effective in a soil medium. This is more surprising with the water soluble materials, nabam and Vancide 51 wettable, than with the other relatively insoluble materials. N-521 is a notable exception since it proved to be equally fungicidal in agar plates and in soil. Thirdly, compound 275 shows specific effectiveness against only two important soil borne pathogens *in vitro* and would not be considered as having promise in preventing a wide variety of diseases. One might expect that N-521, on the other hand, would have a good possibility of successfully controlling a number of fungus diseases. And, finally, in-

formation is provided concerning methods of applying materials to soil for the maximum success. For example, N-521 could be expected to perform well if applied to the soil surface and watered in by rain or irrigation waters. On the other hand, Mathieson 275, 1194, and 1197, handled in this manner, would probably be very ineffective. These materials may prove very successful fungicides in soil if mechanically incorporated.

Screening a wide variety of fungus parasites by several methods provides more extensive information concerning the potentialities of a given compound than would be accumulated through exhaustive field tests by a number of investigators in several different locations. The broad laboratory screen allows a critical evaluation of compounds and increases the probability of success in field trials.★★

Widespread Insect Outbreaks Threaten Crops

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Economic Insect Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture, Washington. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the United States.



By Kelvin Dorward

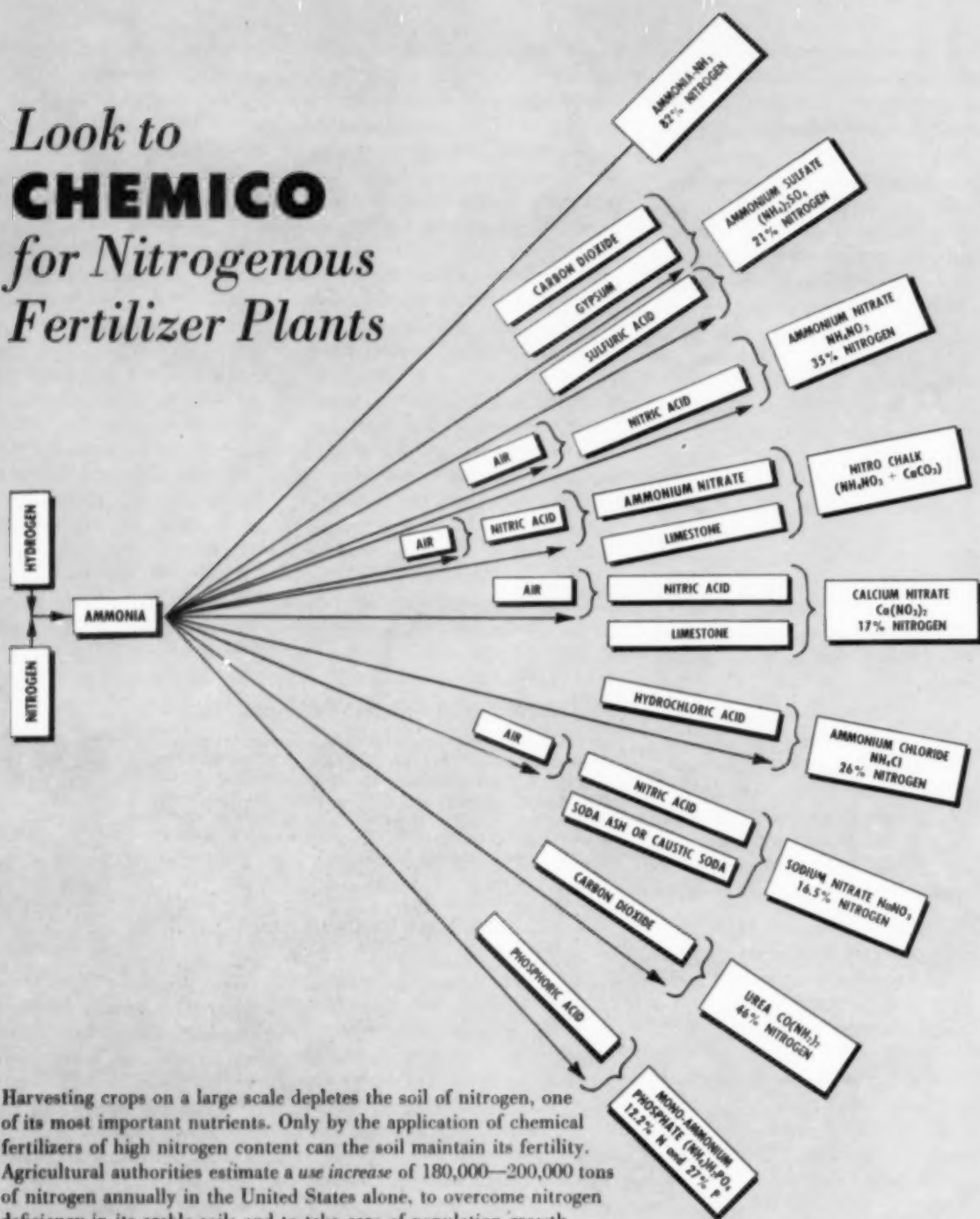
Grasshopper Infestations Serious
GRASSHOPPERS are becoming a serious crop problem in several states, in addition to the damage they do to rangeland. Although some spraying has been done in Idaho for rangeland grasshopper control, natural factors have been very instrumental in reducing the populations. In Lincoln County reductions of from 400 per square yard to as low as one per square yard are attributed to dry weather, low temperature and other weather factors. In Mimidoka County a predaceous wasp has also been active. Control programs for rangeland have been developed and in most instances are under way.

Colorado expects to spray approximately 200,000 acres in South-

eastern Counties; New Mexico will treat 165,000 acres in the Folsom-Cimarron Canyon and Chama-Antonio areas; and in Wyoming, about 122,000 acres in Park County, 10,000 acres in the Guernsey area of Platte and Goshen Counties and 26,000 acres in Johnson County will be treated.

In the Ephraim-Manti, Utah area 20,000 acres of native meadows had populations of serious proportions. One species had populations exceeding 1,000 per square yard in the hatching beds. Over 28,000 acres have been sprayed in this State and the grasshopper situation is the most serious in several years. In southeastern Kansas the infestation was of outbreak proportions, with widespread damage to corn, alfalfa,

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soybeans, grasses and garden crops. Missouri was experiencing rather serious populations throughout the State with second generation *Melanoplus mexicanus* adding to the complexity of the situation in the southern half. Other states which have reported grasshoppers in threatening numbers or requiring control measures include Minnesota, Illinois, Indiana, Kentucky, Maryland, Virginia, Texas, Oklahoma and Nebraska.

Corn Borer Requiring Control

By early July insecticidal treatment for first-brood European corn borer was practically completed in Iowa. Egg and larval counts have been markedly higher than in recent years and infestation as indicated by plant injury ranges up to 100 percent generally over the State. Although not necessarily the case, as a general rule treatment for field corn is usually considered profitable if 50 or more egg masses per 100 plants are present or if extensive leaf bleeding is present on early corn and the corn is more than 35 inches in extended height during first-brood flight. In the early part of the month Iowa had egg mass counts up to 400 per 100 plants in isolated fields. In the central area, counts were 150 masses per 100 plants and in the northern area masses averaged 20-50. In Illinois, counts ranged from 26 to 237 egg masses per 100 plants, with hatch complete.

Minnesota had one of the shortest and most concentrated egg-laying periods in several years. Highest infestations were found in the southwest area where 73 of every 100 plants examined were infested. One-hundred percent shot hole injury was reported as common in southeast South Dakota, and 80 percent of most early corn in Saunders and Dodge Counties, Nebraska had 12 borers per stalk. Virginia, Delaware, and Maryland reported injury to early corn.

Garden Webworm Damages Forage

The garden webworm was one of the principal economic insects during early July. Kansas reported that this insect made it necessary to

cut alfalfa prematurely in localized areas, thereby reducing hay production. Although general over the State, the heaviest populations were in the north central, southern and eastern counties where counts ranged from

Army Worm Outbreak in Minnesota

Heavy army worm infestations in west central Minnesota late in July prompted Gov. C. E. Anderson to declare an emergency. Requests were rushed to insecticide manufacturers to ship emergency supplies of insecticides into the area to control the heavy crop damage which T. L. Aamodt, state entomologist, estimated was running about ten percent.

50 to 200 larvae per square yard. In Southwest Iowa, soybeans and corn were being damaged. Missouri reported the insect generally over the State, with populations in the Missouri and Mississippi River bottoms reaching 4 to 56 larvae per linear foot of row, with damage to corn, soybeans and alfalfa. By the second week in July the larvae were reaching maturity in Missouri; however another later brood of larvae is expected throughout the State. Nebraska reported severe damage in many fields of alfalfa and late-planted corn.

Cigarette Beetles in Carolinas

In a recent report J. N. Tenhet of the Stored-Products Insect Section, Agricultural Marketing Section, advises that early infestations of the cigarette beetle appeared approximately two to three weeks earlier in North and South Carolina tobacco warehouses this year than usual. The overwintered brood emergence of this insect was unusually heavy. Based upon these early populations it is believed that very severe beetle infestations may be expected in the eastern and mid-Piedmont areas of the Carolinas this season. In some cases infestations already approach outbreak proportions. In the Richmond, Virginia area the emergence is about normal, and heavy infestations

are not expected. The same is true for the tobacco moth, with emergence and populations expected to be about the same as for the past three or four years.

Insect Outbreaks Numerous

Other cereal and forage insects which caused damage during July include chinch bugs, armyworms, corn earworms, and aphids. Chinch bugs moved from small grain fields to corn in Kansas where populations up to 500 per hill, with loss of some corn plants, were reported. Spotted armyworm outbreaks occurred in South Dakota, Wisconsin and Michigan, while heavy aphid infestations continued in alfalfa in Arizona and New Mexico.

Fruit insect conditions were about normal for the month: Orchard mites were increasing in New Jersey, Delaware, Pennsylvania, and other areas; second-brood codling moth was requiring attention; and apple maggot flies were emerging from Rhode Island to Minnesota.

Among truck crop insects showing abundant and damaging populations during the month were Mexican bean beetle in areas of Rhode Island, New York, North Carolina and Colorado; squash bug in New Jersey, Tennessee and Illinois, and thrips on onion in Delaware, Virginia, Utah and Colorado.

Phosphoric Acid Application

Direct application of phosphoric acid to soils has been under investigation by the Farm Service Corp., Harlan, Ia. Practical use of the method is suggested for soils rich in potash, lacking only nitrogen and phosphorus. A standard liquid ammonia applicator is used, with ammonia fed to the soil alongside the furrow cutting knife blades, about 6 inches below the surface. The additional tubing is attached to the knife blades, and the phosphoric acid is fed through the tube attached near the top of the blade. One advantage of this method is that coincident application of the two fertilizers helps minimize escape of liquid ammonia, which is frequently encountered in standard application.

Technical SECTION

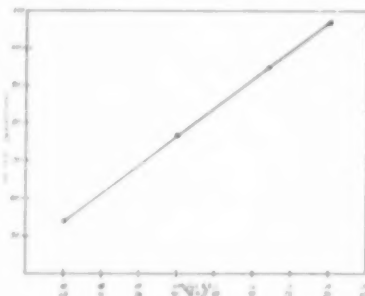
Potash Determination by Photometry

THE official Italian procedure for the determination of potash fertilizer specifies the perchlorate-gravimetric method; however, this method is time consuming, painstaking, and not exempt from errors. To make this determination more rapid, and maintain the same degree of precision, the flame photometer method was investigated. During the preliminary work, the instrument of Schuhknecht-Waibel, fabricated by Zeiss was used. This instrument consists of a photoelectric cell and a filter that is permeable only to the red lines of potassium; namely, 769.9 and 766.5 μ . The instrument employs a very sensitive galvanometer and utilizes an acetylene-air flame. Preliminary tests have shown that it is not convenient to use a strong anodic tension in order to obtain large deflection of the galvanometer, since this produces too many oscillations, which reduces precision of the readings. On the other hand, it was found that a low tension resulted in a great loss of sensitivity.

It can be seen that for each instrument, it is necessary to establish, tentatively, the most suitable anodic tension. For instance, during this work, it was found that an anodic tension of 40 volts and a galvanometric resistance of 0.1 milliohms were the most suitable values. A pressure of 0.4 atm. for air and 400 mm of water for acetylene was used.

Other preliminary tests were made to establish the most suitable

concentration for the solutions. It was found that by using a concentration of 1 to 10 mg K_2O , the line obtained by plotting concentration versus galvanometer readings was not a straight line function. On the con-



trary, concentrations of .07 to .15 mg of K_2O per ml gave almost a linear relationship. The solutions used to obtain the values presented in this paper were made according to the procedure below.

Procedure

A standard solution containing 5 mg of K_2O per ml was prepared, dissolving 1.9788 gm of dry high purity Merck KCl in a liter of distilled water. This corresponds to 1.250 gm of K_2O per 250 ml. (14, 16, 18, 20, 22, 24, 26, 28, 30 ml of this solution were respectively diluted to one liter). Each solution was tested and the readings in table 1 were obtained.

If the concentration of the potash (as K_2O) is 40 to 50%, a sample containing 0.25 gm in 100 ml of water gives a value within the required limits. By use of the table, it is possible to determine the concentration of KCl as a function of K_2O , if the dilution is made according to the specification. It should also be

possible to use an adjusting factor; however, in this case it is necessary to keep in mind that the beginning of the curve is not at 0 but at 10.5, which is the value obtained using distilled water.

The reproducibility of the method is very good, provided the pressure of acetylene and air is maintained constant, and also that the instructions are followed closely.

Another point investigated in this work is the effect of other alkalies and alkali earths that are normally present in potash fertilizers. The effect of sodium, magnesium, and calcium emissions on the intensity of the potassium red lines was investigated. The concentration used was 0.1 mg per ml, expressed as Na_2O , MgO and CaO , and results shown in table 1 and the accompanying graph.

In addition, a series of tests was made using solutions containing potassium chloride equivalent to 0.05 and 0.1 mg of K_2O per ml and from 0 to 1 mg/ml of Na_2O , MgO , and CaO , respectively. The results are shown in table 2. It can be seen from tables 1 and 2 that:

1. Sodium has a positive effect in the sense that the reading is higher when this element is present; calcium and magnesium suppress the reading.
2. Since the concentration of these impurities in potash fertilizers, under normal conditions, is small, the resulting error will be within $\pm 0.5\%$. In the case of raw salts, for instance, carnallite, kainite, and sylvinit, these impurities are higher, therefore, the error may be in the range of $\pm 1.0\%$.

In conclusion, it was found that:

- A. Potash in fertilizer can be determined by using the flame photometer.
- B. The error is within $\pm 1.0\%$.
- C. The time required for a determination is short in comparison with the gravimetric method.
- D. The speed, simplicity, and precision are such that the procedure may be recommended as a standard method.

*P. Gelli, Univ. of Bologna. Translated from the Italian by M. T. Giacchino and checked by V. Saucelli, Davison Chemical Corp., Baltimore, Md.

TABLE 1

METER DEFLECTIONS					
Test No.	K ₂ O mg/ml	Pure K ₂ O	Pure K ₂ O Plus 0.1 mg/ml of Na ₂ O	Pure K ₂ O Plus 0.1 mg/ml of MgO	Pure K ₂ O Plus 0.1 mg/ml of CaO
1	0.00	10.5	10.5	10.5	10.5
2	0.07	54.0	54.5	53.0	53.0
3	0.08	61.5	62.0	60.5	60.0
4	0.09	69.5	70.5	68.5	68.5
5	0.10	77.0	77.5	76.5	76.5
6	0.11	85.0	85.0	84.5	84.0
7	0.12	92.5	93.0	92.0	91.0
8	0.13	100.0	101.0	100.0	100.0
9	0.14	107.0	107.0	106.0	105.5
10	0.15	114.0	114.0	113.0	113.0

The results previously obtained with the Schuhknecht-Wiabel instrument were reproduced using a Perkin-Elmer Model 52C flame photometer by applying the "direct procedure." If the "internal standard procedure" is used, it should be possible to obtain a greater precision in the readings. The Perkin-Elmer instrument affords also the possibility of making a contemporary determination of impurities such as Na₂O, MgO, and CaO.

Literature

1. MINISTERO DELL'AGRICOLTURA E DELLE FORESTE. Official methods of analysis for agricultural chemicals.
2. PERKIN-ELMER CORP. (THE). Instructions for the use of the flame photometer.
3. ZEISS, C. JENA. Instructions for the use of the Schuhknecht-Wiabel instrument for the determination of potassium and phosphoric acid.

Toxicity to Hornworm

The toxicity of 13 insecticides against the tobacco hornworm was compared in the laboratory. The LD₅₀ and LD₉₀ values were determined both as topical applications and as stomach poisons against three sizes of larvae. As contact poisons the order of toxicity was in general as follows: endrin, parathion, isodrin, lindane, malathion=dieldrin=aldrin—toxaphene, heptachlor, Q-137, CS-708, TDE, and DDT. As stomach poisons, the order of toxicity was as follows: endrin, parathion, isodrin, lindane, toxaphene, malathion, CS-798, TDE, Q-137, and DDT. En-

drin and isodrin were 20 to 80 times more toxic than materials which have been recommended for hornworm control and seem worthy of further studies in the field. Parathion and malathion give the quickest kills. Endrin and isodrin were also fairly rapid in their action. F. E. Guthrie, *Jour. Econ. Entomology* 47, #2, 215-218 (1954).

DuPont Liquid Disinfectants

To treat small grains, two new liquid seed disinfectants have been announced by the Du Pont Co., Wilmington, Del.

Both formulations are based on a combination of phenyl mercury acetate and ethyl mercury acetate and are intended for use with wheat, rye, barley, oats, flax, and other similar grain crops. Experimental work starting in greenhouse and test plot evaluations and carrying through to commercial use in spring wheat areas in Minnesota, the Dakotas, and Montana, preceded introduction of the new disinfectants.

One of the new products, Du Pont Liquid 364, is a concentrate for dilution with water and use in slurry treaters. The other, Du Pont Liquid 244, is to be used undiluted in ready-mix (completely automatic) seed treating equipment. Like other Du Pont seed disinfectants, the new products control certain soil-borne and seed-borne diseases and improve stands by preventing seed decay and reducing seedling blights.

TABLE 2

IMPURITIES							
		SODIUM		MAGNESIUM		CALCIUM	
Test No.	K ₂ O mg/ml	Na ₂ O mg/ml	Scale Div.	MgO mg/ml	Scale Div.	CaO mg/ml	Scale Div.
1	0.05	0.00	38.5	0.00	38.5	0.00	38.5
2	0.05	0.10	39.5	0.10	38.5	0.10	38.5
3	0.05	0.25	41.0	0.25	38.0	0.25	38.0
4	0.05	0.50	43.0	0.50	38.0	0.50	37.5
5	0.05	1.00	45.0	1.00	37.5	1.00	37.0
6	0.10	0.00	74.5	0.00	74.5	0.00	74.5
7	0.10	0.10	76.0	0.10	74.0	0.10	74.0
8	0.10	0.25	76.5	0.25	73.0	0.25	73.5
9	0.10	0.50	79.5	0.50	73.0	0.50	73.0
10	0.10	1.00	81.5	1.00	72.0	1.00	72.0

Garden Aerosol Insecticides

The progress report of the University of Maryland, Agricultural Experiment Station, College Park, Md., includes the following summary on insecticide effect in the home garden aerosol:

A combination of 2 per cent dieldrin and lindane is so far the best formulation found for general effectiveness against vegetable insects. Lindane, however, may impart an off flavor to some crops, particularly potatoes when frequent treatments are made near harvest time. No off flavors from this material occur in melons, cucumbers, cabbage or other leafy crops that are eaten uncooked. In single insecticide formulation, malathion has given good general results but cannot be used too frequently on cucurbits as it retards plant development.

Aside from the objective of developing a general formulation, considerable information has been obtained on the performance of the different insecticides used. This information is of considerable interest to the entomologists since the methyl chloride propellant and the methylene chloride solvent used in the aerosol are both highly volatile and are dispersed in the air soon after application, leaving only the insecticidal residues on the plant. Since only technically pure insecticides are used in aerosols, plant damage and toxicity to insects can be attributed directly to the chemical used. Bulletin A-78, January, 1954, page 58.

Herbicide for Melons

A new herbicide, N-1 naphthyl phthalamic acid, gave excellent control of crabgrass and broadleaved weeds in transplanted muskmelons on a sandy soil without affecting the yield, maturity or quality of the melons. The results agree with those in the two previous seasons. The material was applied as a spray at the rate of 2 to 4 pounds per acre within a few days after transplanting. This same herbicide, as well as certain others, also controlled crabgrass in an established asparagus bed.

N-1 naphthyl phthalamic acid caused severe injury and a reduction in yield of sweet potatoes when applied the day after transplanting. However, 2 pounds per acre of chloro IPC and 4 to 8 pounds of N-1 naphthyl phthalimide showed considerable promise for the control of weeds in this crop, but further experimental work is needed. G. F. Warren, 66th progress report, Purdue Univ., Agric. Exp. Sta., Lafayette, Ind.

Dieldrin for Chinch Bug

Spraying a barrier of dieldrin on adjacent fields of small grains and corn or sorghum is recommended to Midwestern farmers by the U. S. Department of Agriculture as a timely and effective way of preventing damage to corn or sorghum crops by migrating chinch bugs.

To be effective, the barrier should be 4 rods wide with half the dieldrin spray swath falling on the small grain, the other half on the corn or sorghum. To prevent "end runs" by the migrating chinch bugs, farmers should spray a 2-rod wide strip about 8 to 10 rods long across the ends of the small grain and corn or sorghum fields at right angles to the barrier.

Dieldrin spray applied in this manner at the rate of a half pound of actual dieldrin per acre immediately before migration begins will stop the bugs for one to two weeks. Spraying may need to be repeated if a heavier-than-usual migration is taking place.

Chinch bug migrations from

small grains to corn usually begin as the grain ripens and the plants dry—in late June and early July in most of the small grain and corn producing Central States. With heavy infestations of the pests in grain being reported from areas in these States, Department entomologists believe that many farmers will find it profitable to control this pest that sucks the juices from its food plants.

Soil Fumigation of Vegetables

Twenty-four organic compounds comprising mainly chlorinated hydrocarbons and allyl compounds were tested at Purdue Univ. for soil fumigating value. As measured by reduction in abundance of the soil microflora, none of the compounds equalled chlorobromo-propene or chloropicrin in value. All/1 alcohol approached these in value and appeared to be worthy of trials under field conditions.

Effectiveness of fumigation was much lower in a muck soil than in a mineral soil. Chlorobromopropene suppressed nitrification for at least 45 days in a mineral soil when used at 100 and 200 p.p.m. (parts per million) of soil. Hexachlorocyclopentadiene at both these concentrations, and chloropicrin at 200 p.p.m., reduced nitrification. These compounds had less marked effects on nitrification in a muck soil than in a mineral soil. Some compounds caused increased nitrification, especially in a mineral soil.

Excellent control of annual grasses and broadleaved weeds in compost manure was obtained by fumigation with methyl bromide. Muskmelon and watermelon seeds were planted after 3 to 7 days of aeration of the manure with no injurious effects.

In field fumigation experiments with a dichloropropene-dichloropropane mixture, hill application using a hand injector gave good control of root-knot nematode on transplanted muskmelons. There was no injury to the plants when the fumigant was applied at least 12 days before transplanting.

Previous trials with soil applications of various chemical fumigants

to control the disease of *Verticillium* wilt in peppermint have yielded negative results. However, in 1952, applications of sodium pentachlorophenate at the rates of 100 and 200 pounds per acre reduced the incidence of *Verticillium* wilt in peppermint from that of the check. This chemical was also very effective in reducing the weed population from that in the check treatment during the early part of the growing season.

G. F. Warren, N. K. Ellis, J. E. Larsen, and H. W. Reuszer. 66th progress report, Purdue Univ., Agric. Exp. Sta., Lafayette, Ind.

Bisulfite Use Discussed

Experiment stations in New York, Pennsylvania, New Jersey, Ohio, Oregon, Wisconsin and New Hampshire report satisfactory results in the use of sodium bisulfite as a grass silage preservative. The compound is said to be economical and easy to apply.

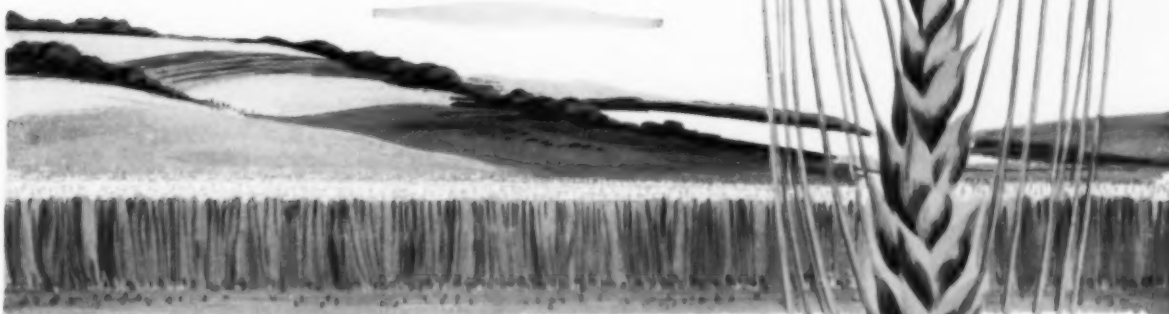
J. B. Shepherd, USDA, in discussing preservatives for silages said, "The liquids and gases formerly used, although successful, have not been entirely satisfactory because of inconvenience, expense, or personal risks. At the suggestion of Pennsylvania State University, sodium metabisulfite was used as a conditioner in our silage making experiments at the Agricultural Research Center, Beltsville, Md. This is a dry chemical that releases sulfur dioxide on contact with the moisture of the cut forage.

"Application of sodium metabisulfite to slightly wilted silage made from red clover, Ladino clover and orchard grass was found to be safe, convenient and relatively inexpensive. Both treated silage and comparable untreated silage had good appearance, odor and feeding quality. The treated silage had a characteristic pleasant odor.

"It retained more carotene and sugar and was slightly more palatable than untreated silage. Otherwise the two silages were not very much different in terms of quality or efficient preservation. The untreated silage was carefully made at a rather favorable moisture content. If the moisture

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CHEMICALS

content had been higher, or if the sludge had been less carefully made, the advantages from using sodium meta-bisulfite would probably have been greater."

Low Gallonage Sprayers

Sprayer studies by the Maine Station show that the low-gallonage, high concentration method of applying fungicides and insecticides to potatoes for disease and insect control is practical, and that it has certain advantages over the conventional high-pressure method.

The chief advantages are the lower initial cost of the low-pressure machines and their subsequent lower operating costs, since they require less water for spraying. Also, the low-pressure machines may be useful for weed control and for potato vine killing prior to digging and harvesting. There is the advantage too, that since low pressure machines are trailer type, they are quickly hitched and unhitched from the tractor, freeing it for other farm operations. Some farmers prefer low-pressure sprayers for that reason.

The studies on the low-pressure machines—made over a 4-year period, 1949-53—indicate that the low-pressure sprayer will probably not give better control of potato diseases and insects than the high-pressure sprayer. However, the experiments have shown that good commercial control of late blight and insects can be obtained with the low-pressure sprayers providing the applications are begun early in the season and are made often enough to keep the foliage well covered with spray when conditions are favorable to diseases and insects.

A tractor-mounted, low-pressure sprayer was used experimentally in 1953. Although late blight was not prevalent that year, tests of this machine indicated it also is satisfactory for spraying potatoes.

Fungicides or insecticides in the form of wettable powders were not suitable for the low-pressure machines used in the experiment. However, the liquid fungicide Nabam and the insecticides DDT and parathion oil emulsions were well adapted for

spraying potatoes with the low-pressure machine. The concentration of the spray mixture was four times (4x) that used for the conventional high-pressure machine.

The use of long drop pipes on the spray boom of the low-pressure sprayer gave better coverage of the materials on the plant and increased the control of aphids.

There was no significant difference in the yields of potatoes as a result of using either of the two kinds of sprayers.

F. W. Peikert and Reiner Bonde, Bulletin 527, Maine Agricultural Experiment Station, Orono, Me.

Antibiotic for Crop Disease

A bacterial plant disease, responsible for heavy damage to the multi-million-dollar tomato and pepper crops in sub-tropical Florida, has been controlled for the first time with a spray of two antibiotics, terramycin and streptomycin.

Dr. Robert A. Conover, plant pathologist at the University of Florida experiment station, has issued a bulletin to growers (No. 54-2) sum-

marizing successful large-scale experiments conducted over two growing seasons with agri-mycin spray. The new treatment was particularly effective against bacterial spot of tomato seedlings used for transplanting.

Dr. Conover reported: "In 1953 in a large experiment in a commercial planting, agri-mycin, an agricultural formulation containing streptomycin and terramycin, gave outstanding control of bacterial spot on tomato seedlings." Ninety-five per cent of the treated plants were found usable, whereas only 27 per cent of the untreated plants could be saved.

Preliminary reports have indicated that a number of bacterial blights hitherto considered incurable are checked by agri-mycin. Halo blight of beans and fireblight of apples and pears have been brought under control in experimental plots at the U.S. D.A. station, Beltsville, Maryland, the Ohio State Experiment Station, and at the University of Missouri. Preliminary success has also been reported after research on peaches, walnuts, cotton and tobacco diseases of bacterial and fungus origin.

Boron Effect on Cabbage

Results of four years of work on the effects of boron on spring and fall cabbage and cauliflower by the Storrs Agricultural Experiment Station, Storrs, Conn., are as follows:

The work indicates that there is a build-up of boron on the plots receiving repeated applications of borax. The first application of 80 lbs. of borax gave increases in yield for both spring cabbage and cauliflower. Fall cabbage and cauliflower showed no difference in yield. When the 80-lb. rate was repeated the next year there was no difference in yield for either crop, indicating that the second application had a static effect on the yield and was in range of toxicity. The 160-lb rate of borax showed no difference in yield for cauliflower but spring cabbage showed a decrease in yield. This rate had reached the range of toxicity. There was no difference in yield for the moderately-limed and heavily-limed plots at the various rates of

borax for either spring or fall cabbage and cauliflower. The external appearance of the crops was normal, except at the 160-lb. rate for spring cabbage which showed some marginal restrictions of the leaves. All increases and decreases referred to are significant or highly significant.

The general boron deficiency symptom in mature cabbage is the development of water-soaked spots in the pith of the main stem, which often turn brown and may disintegrate to form a hollow condition. In cauliflower, the head may turn brown, and the hollow stem develop. Boron toxicity is rare in both of these crops, although at the very high rate of borax application, 160 lbs per acre, some marginal restrictions of the leaves are noted. These restrictions progressed to mild burning, and in a few cases showed severe burning and drying. Reduced yield was the chief criterion of boron toxicity.

J. M. Lent and J. Scarchuk, Progress Report 1, January 1954, University of Conn., Storrs, Conn.

Insecticide Residues in Soil Studies at Puerto Rico

TESTS with soil insecticides have been conducted at Rio Piedras, Puerto Rico, to determine how long treated soils will remain toxic, "for if an insecticide continues to be toxic for some years after application, the soil to which it has been applied may prove to be permanently sterile to injurious insects."

Results of tests with just-hatched grubs of *Diaprepes abbreviatus* L. as biological indicators of the residual effect of insecticides mixed with soil were much more consistent and showed little loss of toxicity in 3 years as compared with the tests using field-collected white grubs. Thus tests with third- or last-instar grubs of *Phyllophaga* (or *Lachnosterna*) *portoricensis* Smyth and *P. vandemei* Smyth, as well as with first-instar white grubs of these species, although not entirely conclusive, appear to indicate that, after being mixed with soil for 3 years, chlordane is not nearly so toxic to white grubs as when originally applied. But the latest results with weevil grubs are almost identical with those of 3 years ago.

Even when freshly applied at the rate of 10 pounds per acre, the gamma isomer of benzene hexachloride did not kill just-hatched grubs of *Diaprepes abbreviatus* L., and cannot be recommended for field application to soils infested with them. This insecticide continued to be almost as effective against white grubs 3 years later as when originally applied to soil infested principally with them.

Aldrin appeared to be fully as effective against the weevil grubs of *Diaprepes abbreviatus* L., as when first applied 3 years earlier, and was found to be very toxic to the grubs of *Ligyris* (which are of very minor economic importance). Even if it is less toxic to third-instar *Lachnosterna* white grubs at the concentrations recommended for original field application (2 pounds per acre) it will kill these grubs in the first-instar.

DDT appeared to be only slightly toxic to *Ligyris* grubs as compared with Aldrin. For cucumbers

and for grubs of *Diaprepes abbreviatus* L., and the endemic species of *Lachnosterna*, DDT experienced no appreciable loss in toxicity in the soil with which it had been mixed 3 years earlier.—George N. Wolcott, *Jour. of Agriculture*, Univ. of Puerto Rico 38, #2, 108-114 (1954)

Sulfur Deficiency in Alfalfa

Studies on the effect of sulfur deficiency on the amino acids and proteins of alfalfa were continued at Purdue Univ. For this purpose alfalfa was grown in sand culture using a nutrient solution devoid of sulfur. Control plants received the same nutrient with added sulfate. Analysis of five successive cuttings of control and sulfur-deficient plants showed that aspartic acid and arginine increased significantly in both stem and the leaf of the sulfur-deficient plant, confirming previous work.

The decrease in all of the other 16 amino acids observed previously for the whole plant (leaf and stem) was found to be confined to the leaf, with only an insignificant change occurring in the stem. This may indicate that the proteins of the stem are more essential for the life of the stem than certain leaf proteins are for the maintenance of the leaf, and that less essential leaf proteins are sacrificed during sulfur deficiency. To test this hypothesis, studies are underway on the fractionation of the leaf cytoplasm of normal and sulfur-deficient plants. Preliminary electrophoretic studies of normal leaf cytoplasm are presented in the report.

In a search for alfalfa strains of high methionine content, a total of 24 selections harvested in 1952 by R. L. Davis, Department of Agronomy, were analyzed microbiologically for methionine. The values ranged from 73 to 87 milligrams of methionine per gram of total nitrogen, which is in the range of values reported previously for the alfalfa selections harvested in 1951. H. Matsumoto and E. T. Mertz, 66th progress report, Purdue Univ., Agric. Exp. Sta. Lafayette, Ind.

Literature Available

The following list reviews a series of bulletins on fertilizer, insecticide and fungicide recommendations, controls, etc. For the most part, these bulletins and reports are prepared by the various state agricultural experiment stations, and copies may be obtained by writing directly to the respective stations.

SOIL FERTILITY by George Smith. Nutrient needs of crops described, with tabular presentation of specific requirements; effect of irrigation; financial aspects of output yield. Bulletin by MFA Plant Foods Division, Columbia, Missouri.

INSPECTION OF AGRICULTURAL SEEDS, by F. W. Quackenbush, A. S. Carter, L. C. Shenberger, and P. Balbach. Average analyses of samples in inspection, nature of seed misbranding, means of testing described. Circular 399, Purdue Univ., Agric. Exp. Sta. Lafayette, Ind.

AGRICULTURAL PROGRESS REPORT 1952-1953. Bulletin A-78. Report on soybean testing program, corn hybrids, small grain varieties, climate effect on plant growth, effect of soil conditioners on crop yields, chickweed control in alfalfa, weed control in corn, insecticides and fungicides in crop yields, Japanese beetle control, etc. Univ. of Maryland, Agric. Exp. Sta., College Park, Md.

WEED CONTROL IN SWEET CORN FOR WESTERN WASHINGTON by H. H. Wolfe and D. V. Peabody. Dinitro amine recommended for pre-emergence application to control smartweed, wild mustard, corn spurry and wild buckwheat. Circular EMP 16, Washington Agricultural Experiment Stations, Pullman, Washington.

ANTS AS PESTS by J. C. Schread and N. Turner. Chlordane spray controls carpenter nest. Control in houses, gardens, lawns, described. Circular 188, Connecticut Agricultural Experiment Station, New Haven.

COTTON PRODUCTION INSECT AND DISEASE CONTROL . . . S. CAROLINA, 1954. Production practices, cotton pest controls, disease control, dusts and dusting equipment, sprayers, etc. Circular 383, Clemson Agricultural College, Clemson, S. C.

POTATO DISEASE AND INSECT CONTROL WITH LOW GALLONAGE SPRAYERS by Frank W. Peikert and Reiner Bonde. Sprayer studies show that the low gallonage, high concentration method of applying fungicides and insecticides to potatoes for disease and insect control is practical, and that it has certain advantages over the conventional high pressure method. 16 pages, Bull. 527, Maine Agric. Exp. Sta., Orono, Me.



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2. Solvent used _____
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4. Recommended dilution _____
5. Lbs. toxicant / gal. of concentrate _____
6. Desired emulsion stability _____
7. Shelf life expected _____
8. Ease of dispersion important? _____ or small container
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10. How is concentrate mixed and evaluated in laboratory tests? _____



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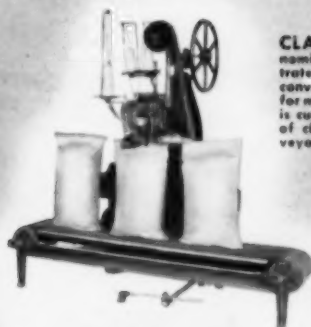
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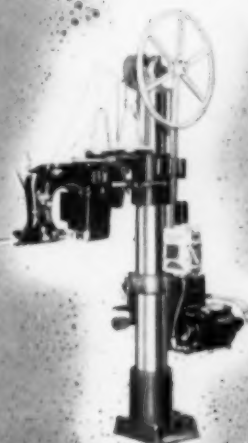
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CLASS 21800 (left) for fast, economical closing of paper bags. Illustrated is Style 21800 H with 5 ft. conveyor and 80600 H sewing head for making tape bound closure. Tape is cut off automatically at each end of closure. Sewing head and conveyor adjustable vertically.

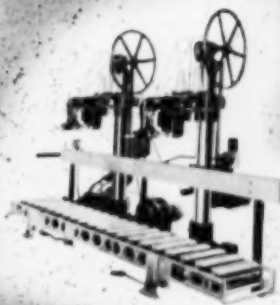


CLASS 20500 (above) machines are heavy duty, high production units for closing medium and heavy weight bags. Available with power-driven horizontal conveyor, inclined conveyor, or both; or with conveyor transmission unit only, for plant production line.



STYLE 20100 H (left), is a heavy duty, high production column type machine designed for use with plant conveyor systems. Sewing head is pedal controlled.

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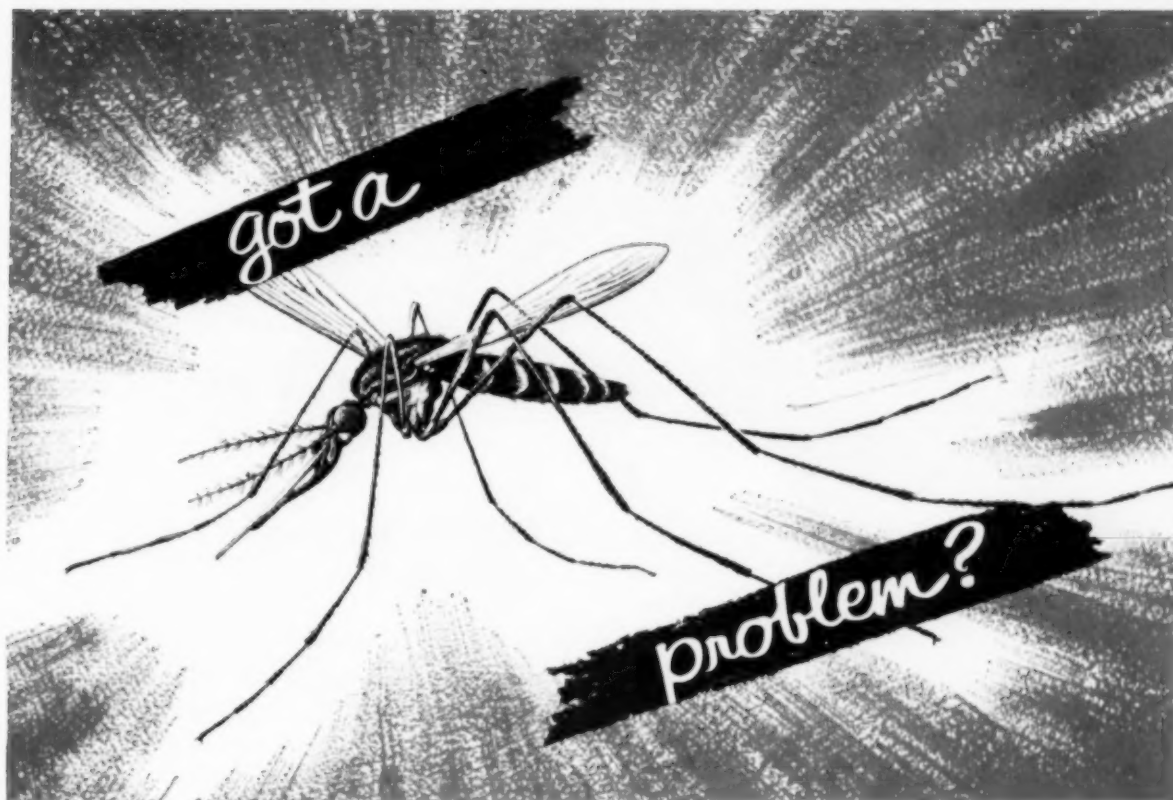
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perienced users as Pest Control Operators, Public Health Organizations and Mosquito Abatement Crews.

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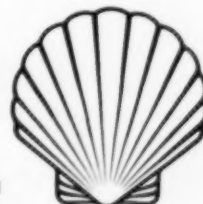
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AGRICULTURAL CHEMICALS

Suppliers' BULLETINS

New Shell Booklet on Aldrin

A new booklet "Cotton Bugs . . . and how to lick 'em with aldrin and dieldrin" was issued recently by Shell Chemical Corp., New York. The 12-page folder is directed to answer the growers' questions and gives data on application rates for control of thrips, boll weevil, and bollworm.

DuPont Aerosol Booklet

A new bulletin on the use of methoxychlor in aerosol insecticide sprays and oil-based sprays is offered by E. I. du Pont de Nemours & Co., Wilmington, Del. The booklet gives knockdown data and suggestions for formulation in general contact and space sprays . . . as well as in aerosol dispensers, livestock sprays, and pressurized cattle sprays. Technical data on solubility, types of solvents, emulsifiers, and a bibliography of manufacturers' bulletins are included also.

New Safety Booklet

"Accidents add to the cost of doing business" is the theme of the National Safety Council's new booklet, "Plus Cost." The booklet tells how accidents nibble at profits and outlines the "why" and "how" of accident control.

Intended specifically for those small firms with relatively few employees and no safety staff, "Plus Costs" sets down seven easy steps for eliminating accidents and suggests sources of help. The booklet explains in non-technical terms just how these common-sense principles make for a good safety program and at the same time increase production.

Single copies of the eight-page booklet, attractively illustrated with

two-color drawings, may be obtained by writing the Small Business Program, National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

Acrylonitrile Bulletin

A new 8-page technical bulletin on acrylonitrile is available from the chemicals department, Union Carbide International Co., a Division of Union Carbide and Carbon Corp. The reactions of acrylonitrile and its major uses are described. Properties, constant-boiling mixtures, specifications, and shipping data are included.

Acrylonitrile polymers are used in soil conditioners. Acrylonitrile itself reacts to form compounds used as solvents and intermediates for insecticides.

Portable Ventilator

A new portable ventilator has been announced by the manufacturer, Mine Safety Appliances Co., Pittsburgh. Used as a blower or as an exhaust, the two-way ventilating system is a portable unit which is said to have many applications in a variety of industries. Suggested applications include removing toxic or fume-laden air from confined areas; removing smoke from factory operations; dust removal in dry chemicals handling; or to remove fumes resulting from spraying. It may be used either with or without an accompanying collapsible air duct.

Unique Storage Building

Twenty-five foot high buttress walls of reinforced concrete are novel features of the new storage and operational building at South Point, O., being built by Nitrogen Division,

Allied Chemical & Dye Corp. Set on the walls is a 14,400-square-foot standardized steel building produced by Luria Engineering Co. of Bethlehem, Pa.

Normally, the engineers report, such steel-framed buildings are erected on ground-level foundations. Principal reason for high concrete walls at the Nitrogen unit is to withstand stress of huge sloping piles of bulk materials which will be stored in the warehouse.

Grace "Acrea" Bulletin

Grace Chemical Co., New York, offers a two-color bulletin on the uses and advantages of "Acrea", a solid nitrogen-urea fertilizer compound with 45% nitrogen. The manufacturer points out that the product is particularly suitable for air application on rice and other crops. It is said also to be water soluble, non-corrosive, and compatible with most spray materials for application in combination insecticides and fungicides.

Grower's Malathion Guide

The summer, 1954 edition of *American Cyanograms* contains four pages of charts showing what amounts of malathion should be used on specific fruit, vegetable crops and ornamentals in control of specific pests. The chart indicates also the form (liquid, dust, powder) to be used in application.

Besides recommendations, the article accompanying the tables, and the charts themselves caution the grower against use of malathion on certain crops to which injury may occur under some conditions.

Agrimycin Tree Spray

Field trials of agrimycin as a fruit tree spray for fireblight control are currently underway. The antibiotic compound is a wettable powder for use in standard sprays and is recommended for use in a concentration of 100-500 parts to one million parts of water. Pfizer & Co., New York, has distributed test amounts of the compound to encourage study of its effectiveness in controlling various fruit diseases.

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AGRICULTURAL CHEMICALS

INDUSTRY News

Pratt Moves to Paterson

B. G. Pratt Co., manufacturers of garden insecticides, announced that they will move on or about August 15th to 204 21st Avenue, Paterson, N. J. The firm has been in the insecticide business for 52 years.

New Potash Import Concern

Potash Import & Chemical Corp. has been organized in New York to bring potassium muriate and sulfate into eastern US ports from western Germany. Henry Mann is president of the new firm, and W. Duehrssen is vice president.

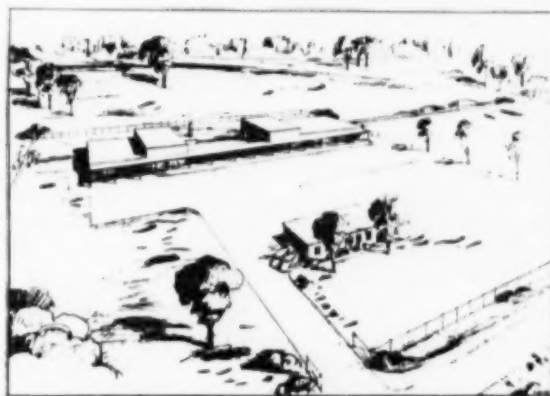
Powell To Sell "Fly Flakes"

John Powell & Co., Div. of Mathieson Chemical Corp., has just been named national sales agents for "Fly Flakes," product of Florida Agricultural Supply Co., Division of Wilson & Toomer Fertilizer Co., Jacksonville, Fla. Powell will handle sales throughout the United States except for half a dozen states in the southeast which will be served by Florida Agricultural Supply Co. home office. The Powell organization will also be active in the export market on the new product, which incidentally, is reported to be selling extremely well after its introduction earlier this year.

N. Y. Pesticide Conf. Nov. 9

The 16th annual New York State Insecticide-Fungicide Conference, sponsored by Cornell University and the New York State Agr. Experiment Station, will be held in Ithaca, N. Y., Nov. 9-11. Sessions will be

Artist's sketch of the new formulating plant and sales office of Geigy Agricultural Chemicals Division of Geigy Chemical Corp., to be built at Des Moines, Ia.



New Geigy Plant Under Construction in Des Moines, Iowa

Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., New York, announced last month that construction of a new \$500,000 formulating plant and sales office is underway at Des Moines, Iowa.

The new installation, which will replace the Midwest territorial headquarters at Burlington and Lockridge, Iowa, will service an area from the Rocky Mountains to the Alleghenies.

Plans include two formulating plants, one for the manufacture of insecticides and fungicides and the other for herbicides, as well as a sales office and a service building incorporating a quality control laboratory.

Mr. E. C. Gerdes will continue in charge of Geigy's Midwest branch and Mr. Wayne Rorman as the plant manager when the Des Moines move is completed.

held as usual in Bibbins Hall. Participating in arrangements for the program are Dr. Charles Palm, head of Cornell's Entomology Department, Prof. O. C. French of the Agricultural Engineering Department, Dr. J. M. Hamilton of the Plant Pathology Department, Geneva, Dr. P. J. Chapman, Department of Entomology, Geneva, and G. F. Kemp, Department of Plant Pathology, Ithaca. Requests for room reservations should be addressed to the Ithaca Hotel.

Rohm & Haas Files Suit

A patent infringement suit was filed early in July by Rohm & Haas Co., Philadelphia, against E-Z Flo Chemical Co., Lansing, Mich., and its affiliate, Diamond Fertilizer Co., Sandusky, O. The suit charges that the activities of the defendants in the selling of "E-Z-Flo" brand of "Nabam" constitute an infringement of U. S. reissue patent 23,742, under which Rohm & Haas sells its "Dithane" brand of fungicides.



Toxaphene To Minneapolis

This U. S. Air Force C-47 plane, loaded with technical toxaphene from the Hercules Powder Co. plant in Brunswick, Ga., was flown to Minnesota to combat an armyworm invasion. Flax, corn, and small grains were principal crops threatened, and supplies of toxaphene dusts and sprays had been rapidly depleted. Authorities were quoted as saying that fully 50 per cent of the crop would have been lost if prompt application of insecticides had not been made possible.

NE Agronomists Elect

Elections of new officers were announced last month at a business meeting of the Northeast Branch, American Society of Agronomy, at the College of Agriculture, Rutgers University. Dr. Samuel R. Aldrich, Cornell Univ., Ithaca, is the new president, and Lester H. Smith of the University of Vermont is vice-president. Dr. R. R. Robinson of the USDA pasture laboratory, Univ. of Pa., was re-elected secretary-treasurer. Next year's meeting will be held at State College, Pa.

Continental Insect Control

The Senate last month passed a bill (S.3697) authorizing the Department of Agriculture to cooperate with the governments of Canada or Mexico, or their local representatives, for the control of incipient or emergency outbreaks of insect pests or plant diseases.

Respirators for Dust Users

Respirators for the protection of operators from dusts and mists of parathion insecticides during field use were discussed in a release by the Interdepartmental Committee on Pest Control dated May 4, 1950. Another release was issued May 1, 1952, by the Bureau of Entomology and Plant Quarantine in cooperation with the Insecticide Division, Livestock Branch of Production and Marketing Administration of the Department of Agriculture, and Food and Drug Administration of the Federal Security Agency, listing respirator units which

gave adequate protection against dusts and mists and low vapor concentrations of parathion, aldrin, dieldrin, chlordane, EPN (O-ethyl O-p-nitrophenyl benzene thiophosphate), nicotine and tetraethyl pyrophosphate or hexaethyl tetraphosphate.

At the time of the latter release no satisfactory respirator was available for protection against demeton (Systox). The use of a filter or half-face gas mask was necessary. In close cooperation with manufacturers of respiratory protective equipment, it has now been found that following respirators will give adequate protection against dusts, mists and low vapor concentration of demeton.

1. Mine Safety Appliances Co. Farm Spray Respirator No. CR-72183 equipped with cartridge No. CR-49293 and filter No. 73488. Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh, Pa.
2. American Optical Company respirator No. 5055 equipped with filter No. R-57 and cartridge No. R-51. American Optical Co., Southbridge, Mass.
3. Willson Products, Inc. Agritox Respirator equipped with cartridge No. 11A and filter No. R490. Willson Products, Inc., Reading, Pa.

The respirators listed above can also be used for protection against parathion, aldrin, dieldrin, chlordane, EPN, nicotine, tetraethyl pyrophosphate, and hexaethyl tetraphosphate.

From the report of July 12, 1954 by H. L. Haller, USDA, Crop Research.

Pacific Ammonia Plant

The Pacific Supply Cooperative, Walla Walla, Washington, has announced that it will be the principal marketer of agricultural chemicals and fertilizer for a new \$12-million chemical plant to be constructed on the Columbia river near Walla Walla.

Columbia River Chemicals, Inc., builder of the plant, has announced that construction is to begin this summer, with production of some materials expected by late 1955.

Charles Baker, general manager, said that Pacific Supply will handle all anhydrous ammonia, aqua ammonia, urea, ammonium sulphate, and urea-ammonia nitrogen solutions produced for agricultural purposes, except those destined for export.

Daily capacity will be 160 tons of anhydrous ammonia, 110 tons of urea, and 140 tons of ammonium sulphate. Part of this will be for industrial purposes.

The plant will be somewhat similar to the Cooperative Farm Chemicals Association nitrogen fertilizer plant at Lawrence, Kan., which is nearing completion.

The Pacific Supply Co-op is a regional wholesale association serving farmers in Washington, Idaho and Oregon.

Safety Section Meets Oct. 18

The Fertilizer Section safety program of the National Safety Congress, to be held October 18 and 19 in Chicago, includes a varied series of topics for discussion. Chas. W. Nelson, Univ. of Chicago, will outline a safety program for reaching the worker, and W. C. Creel, Dept. of Labor, N. C., will review a small plant safety program "that will work."

Vernon Gornto, Smith Douglas Co., general chairman of the session, will report the activities of the section for the year just closing, and a new slate of officers is to be elected.

J. Miskelly, Mathieson Chemical Co. is scheduled to demonstrate common hazards and suggest corrective measures. A panel discussion open to the assembly is designed to open technical questions not reviewed in other reports.

AGRICULTURAL CHEMICALS

Downey Appoints Henderson

A. Henderson has been appointed sales manager of the Downey Fertilizer Co., Downey, Calif. Mr. Henderson was formerly employed by Consolidated Bakers, Toronto.



Sackett Designs Plant

Construction of a new \$750,000 fertilizer plant near Mt. Gilead, O., is scheduled to get underway immediately. The plant, to be designed and built by A. J. Sackett and Sons Co., Baltimore, for the Farm Bureau Coop. Assn., Columbus, will have a capacity of 70,000 tons of granulated fertilizer annually, and will be completed and in full scale production by July, 1955.

Airplane Treatment Req'd.

Procedures that have been followed voluntarily for years by airline companies to prevent aerial transport of Japanese beetles are now specified and required by the USDA. Effective July 24, the companies are required to procure and apply the prescribed pyrethrum-DDT aerosols.

NH₃ Conference in Wisc.

The first Madison Anhydrous Ammonia Conference, being sponsored by the soils department of the Univ. of Wisconsin; the Great Lakes region of the Agricultural Ammonia Institute; and the A.A.I., will be held August 18th at the Edgewater Hotel, Madison, Wisc.

According to Professor C. J. Chapman of the University's Soils Department, conference chairman, advance registrations indicate an attendance of more than a thousand.

Several of the nation's top agricultural scientists will speak, and a trade show will be staged in Memorial Union Building on the campus.

Bemis College Fellowships

Bemis Bros. Bag Co., St. Louis, as in previous years, will sponsor fellowships for two college professors for the study of the company's organization and operation. R. W. Briggs,

Grinnell College, Grinnell, Ia., and Dr. W. M. Schneider, Emmanuel Missionary College, Berrien Springs, Mich., are this year's appointees.

Entomologist Applications

The City of Los Angeles, Civil Service Commissioners, announced that an examination will be held shortly for the post of Entomologist. Applications to take the examination must be received by August 25. The duties entail professional entomological work in connection with public health insect control activities. Further information is available from J. W. Hawthorne, 5 City Hall, Los Angeles.

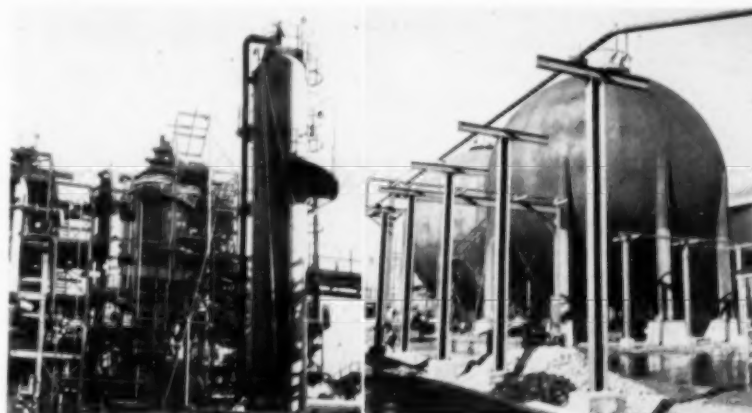
NFA Posters Distributed

"How to Take a Soil Sample" cartoons have been made into wall posters by the National Fertilizer Association, 616 Investment Bldg., Washington, D. C., and are being sold at \$20.00 per hundred. Messages may be imprinted on the posters by the firms distributing them.

Atlantic Agricultural Ammonia Plant in Operation

The Atlantic Refining Co., Philadelphia, late in July announced the start of production at its new synthetic ammonia plant in Philadelphia, which has been under construction since 1953. The unit is designed to produce 100 tons of anhydrous ammonia daily, and was expected to reach this production about the fourth week in July. Approximately

Right: Two anhydrous ammonia storage tanks, each having a capacity of 750,000 tons. **Left:** Source of hydrogen for anhydrous ammonia plant is Atlantic's cat-forming unit.



Woudhuysen Merculine Data

With the acceptance of labels for "Merculine" by Washington and Ottawa, H. L. Woudhuysen & Assoc., New York, have issued a report on application and use of this fungicide, as well as information on its physical and chemical properties. The 11-page report gives dosage recommendations, cautions users against mercury hazards, etc.

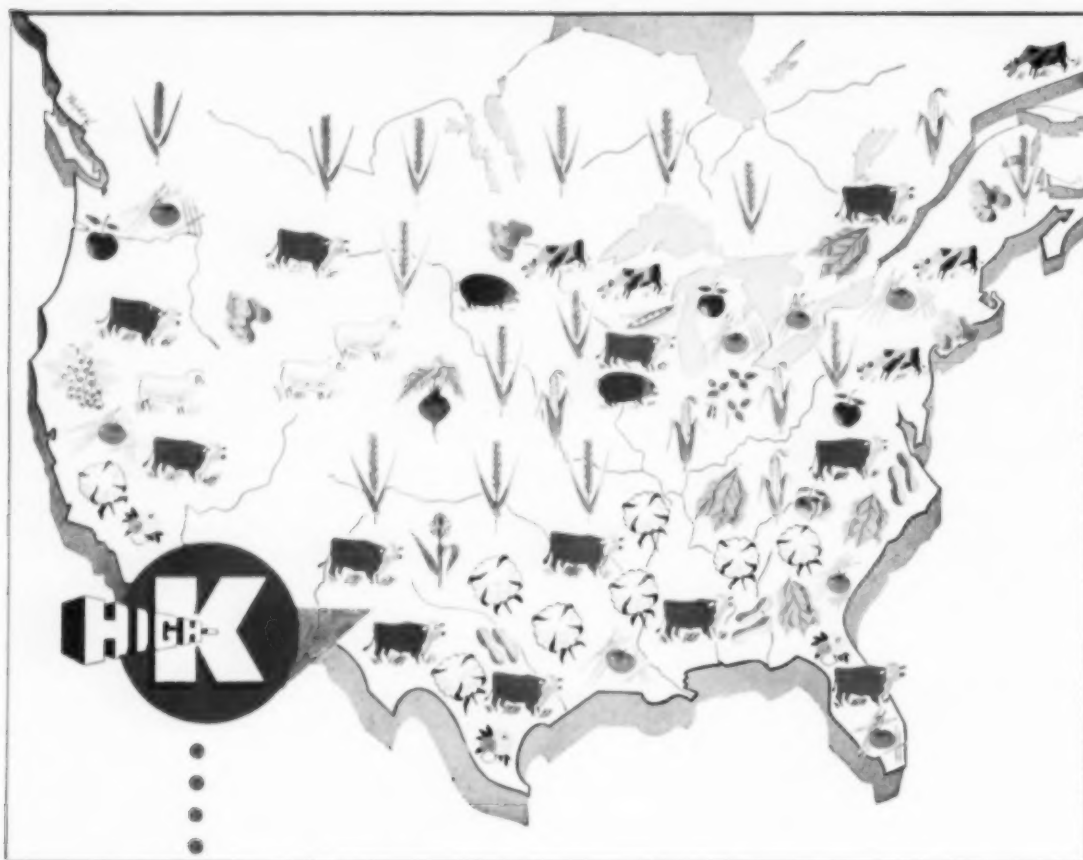
New Atlantic Bag Plant

Construction of a new \$225,000 bag manufacturing plant has been started in St. Augustine, Fla., by the newly formed textile corporation, Atlantic Bag Co., Inc. Production capacity of the new plant will range from 50,000 to 75,000 bags daily, for bagging fertilizer, feeds, seeds, potatoes, etc. R. Pounds is president of the new firm, and J. A. Baggs is vice president. Both officers were formerly with Mente & Co., Savannah and then August Burlap Bag Co., Savannah.

40 per cent of the output is being marketed for agricultural use, and the balance will be sold to manufacturers of various chemical products.

The Atlantic unit utilizes by-product hydrogen from the company's catalytic reformer gas to react with air in the production of ammonia. Compression, refrigeration, filtering and washing units are used in various stages of the reaction.

Two globular storage tanks, each with a capacity of 750,000 tons, will hold two-weeks output of the plant.



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...by using modern mining facilities and
up-to-date processes to produce **HIGH-K*** Muriate
of Potash for plant food manufacturers.

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FMC Buys USI Plant

The pesticide business of National Distillers Products Corporation's USI Division, and the plant which the division has operated at Fairfield, Md. have just been acquired by Food Machinery & Chemical Corp., San Jose, Calif. The acquired properties will be operated by FMC as The Fairfield Chemical Division under the general management supervision of J. V. Vernon, president of FMC's Niagara Chemical Division, Middleport, N. Y.

The announcement indicates that the new division will conduct the affairs of the pesticide chemical phase of the business in the same general manner as in the past. The pesticides sold by USI have included pyrethrum, p. renones, piperonyl butoxide, allethrin, grain protectants, etc. Former USI personnel will be retained, continuing to operate under previous supervision. Both Russell Stoddard, formerly coordinator of insecticide operations for USI, and John Rodda, manager of insecticide sales, will be active in operation of the new Fairfield Chemical Division of Food Machinery & Chemical Corp.

Monsanto Names Dunwody

Donald Dunwody, Boston, has been made San Francisco district sales manager for Monsanto Chemical Co.'s Inorganic Chemical Division, effective August 1. Mr. Dunwody succeeds R. T. Clark, who recently was transferred to Springfield, Mass.

C&C Advances Boden, Mullin

V. H. Boden and D. B. Mullin have been appointed assistant sales managers of the industrial chemicals sales department of Carbide and Carbon Chemicals Co., a Division of Union Carbide and Carbon Corp., New York.

Shell Film on Grasshoppers

The Agricultural Chemicals Division of Shell Chemical Corp., New York, has recently completed a new movie describing grasshoppers, the damage they do, and how they are controlled with modern insecticides. "Exit Grasshoppers," a full-color

16mm, sound film, about 10 minutes long, shows recommended control techniques for crop and range land.

Plant Food Names Bingham

Plant Food Corp., Los Angeles, has appointed John J. Bingham man-



JOHN J. BINGHAM

ager of its northern division, with headquarters at Bakersfield, Calif. Mr. Bingham was formerly with Pacific Guano Co., Berkeley.

Dusters Meet Oct. 26, 27

The annual Dusting and Spraying Conference will be held October 26, 27th at the Chinook Hotel, Yakima, Wash.

Phytopaths to Meet Aug. 25-27

REPORTS dealing with disease resistance, seed treatments, diseases of specific crops and small grains, etc. highlight the program scheduled for the 46th annual joint meeting of the American Phytopathological Society, Pacific Division of the A.P.S., and Potato Assn. of America to be held August 25-27th at the YMCA Conference Camp, Estes Park, Colo. W. J. Henderson is chairman on local arrangements.

Business meetings held in the course of the conference will be directed by G. F. Weber, president of the council for 1954; and Gilbert Stout, president of the Pacific division. The following Technical sessions and the respective chairmen follow:

Virus Diseases of Orchard Crops. D. F. Millikan.
Diseases of Cereal and Other Field Crops. Thor Kommedahl.

Butz, USDA Appointee

Dr. Earl L. Butz, Purdue University, was scheduled to become Assistant Secretary of Agriculture on August 1st, succeeding J. H. Davis who resigned this post to head the Moffett program at Harvard University. Dr. Butz will be in charge of marketing and foreign agricultural relations agencies.

Wood Joins Wilson-Meyer

Marlowe L. Wood, Salt Lake City, has been named to the sales staff of Wilson & Geo. Meyer & Co., representatives of Western Phosphates, Inc.

Westvaco Phosphate Deposits

Westvaco Mineral Products Division of Food Machinery & Chemical Corp., New York, recently acquired extensive deposits of high grade phosphate rock and shale in Rich County, Utah.

Laird Named Mgr. V-C

Douglas W. Laird has been named assistant manager of the purchasing department of Virginia-Carolina Chemical Corp., Richmond, Va. Mr. Laird succeeds D. M. Low, who retired on July 1st, after more than 50 years with V-C.

Nematology: Soil Treatments. J. N. Sasser.
Diseases of Vegetable Crops. John Owen.
General Symposium on Concepts and Problems of Nematode Diseases of Plants. Gerald Thorne.
Smut Diseases of Small Grains. W. M. Bever.
Diseases of Fruit Crops. Harley English.
Virus Diseases. W. H. Sill.
Diseases of Forest Trees and Ornamental Plants. Lewis Roth.
Joint Session with the Potato Association of America. S. B. Locke.
Symposium on Concepts and Problems of Virus Diseases in Plants. W. C. Price.
Seed Treatment Conference. D. C. Arny.
Oak Wilt Conference. A. J. Riker.
Chemotherapy. G. A. Zentmyer.
Genetics of the Fungi. H. H. Flor.
Antibiotics. C. Leben.
Diseases of Forage Crops. E. W. Hanson.
Disease Resistance. M. E. Gallegly.
Physiology of Fungi and Diseases of Plants. G. Gries.
Virology. Frank Ross.
Diseases of Small Grains. R. Caldwell.
Fungicides. F. L. Howard.



From the air—a view of rock storage and dryers at Pierce, Florida, center of A.A.C. mining operations. Florida Pebble Phosphate Rock is the source of phosphorus widely used in the chemical industries, in its elemental form as well as in phosphoric acid, phosphates and phosphorus compounds. This pebble rock is also the principal source of the most important—and most generally deficient—plant food element essential in maintaining and improving crop yields. Health, growth, life itself, would be impossible without phosphorus—often called the Key to Life.

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Part of the almost continuous procession of freight cars that load at Pierce.

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W. Gray, California, Dies

William D. Gray, secretary-treasurer of the Western Agricultural Chemicals Association died in Oakland, Calif., May 15th.

Mr. Gray became secretary-treasurer of the Association in 1944 (known at that time as the Pacific Insecticide Institute). Prior to that time, he had been west coast manager of General Chemical Corp., and a secretary and director of Peyton-DuPont securities in New York.



WILLIAM GRAY

GenChem. HCA Herbicide

A promising new herbicide for control of Johnson grass is announced in the product "HCA Weed Killer" by General Chemical Division, Allied Chemical & Dye Corp., New York. The product is based on hexachloroacetone. Recent tests with HCA on Johnson grass are reported to be quite successful, and country wide tests are underway. Other tests are being made at various agricultural experiment stations.

A single treatment with HCA, used as a fortifying agent for diesel and other weed oils, is reported to kill 80 to 90 per cent of the treated clumps, rootstocks and all. A second or third clean-up application is said generally to give complete control.

The HCA-weed-oil mixture is applied by spot-oiling the crowns of the Johnson grass with a low pressure or gravity feed spray. This treatment has been found effective in cotton, alfalfa, and non-crop areas.

In cotton and non-crop areas, HCA Weed Killer can be applied at any time until the Johnson grass stems glaze over. Where Johnson grass is thick and high in non-crop areas, mowing or scything the grass just before treatment has facilitated applications. The best time for using HCA Weed Killer in alfalfa was found to be right after cutting and removing the crop, with applications made on the short, regrowth Johnson grass in the stubble. Treatments

in young alfalfa in the spring also were effective.

At present, General Chemical is suggesting HCA Weed Killer for experimental use in controlling Johnson grass in cotton, alfalfa, and also in non-crop areas. Tests are continuing with a view toward extending the uses of the new weed killer. Experimental samples are available for federal and state research agencies, and restricted sales will be made to qualified growers interested in

conducting tests on their own farms. Based on further successful tests, General Chemical plans large-scale commercial production of HCA Weed Killer for next year.

A. P. Schulze Joins Diamond

New manager of public relations and advertising for Diamond Alkali Co., Cleveland, is Arthur P. Schulze. He joined the company after serving seven years with Hill and Knowlton.

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FLAKE • LUMP • POWDER

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AVAILABLE IN 24 GAMMA AND IN 36-40 GAMMA

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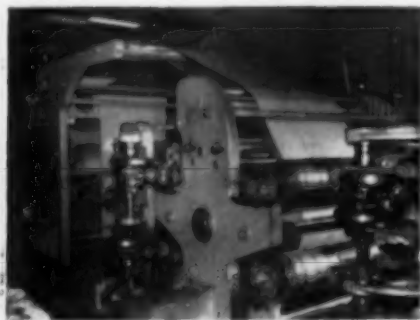


Photo at right shows V-C engravers making printing plates. Well-designed, expertly printed bags have real sales appeal—put your product out front. Photo above shows one of V-C's multi-color printing presses.



A battery of sewing machines staffed by highly-trained operators and inspectors. Modern machinery, skilled operators, and diligent inspectors, mean better-built, longer-lasting V-C Bags for your product.

THE BAG you use to package your product is only one of many items essential to your business success. But to the V-C Bag Division, the manufacture of better bags is a full-time job. That's why it will pay you to discuss your bag problems with a V-C representative. Possibly he can make suggestions that will improve or lower the cost of your packaging. Let him tell you about V-C's expert designing, printing, construction, and speedy service and delivery of V-C Multiwall Bags.



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G. N. Olson



H. Millington



H. R. Bishop

**Spencer
Names
Olson,
Millington
and
Bishop**

Spencer Chemical Co., Kansas City, has announced the selection of three men to head new district sales operations for industrial chemicals in New York, Chicago and Kansas City. The reorganization signals Spencer's planned entry into the polyethylene field and general expansion in industrial chemicals.

The new territory heads are: George N. Olson, district sales man-

ager, eastern district (New York), and Howard Millington, district sales manager located in the Kansas City office, both with Spencer several years, and H. R. Bishop, district sales manager, north-central district (Chicago), a new man in the organization. Mr. Bishop comes to Spencer from the Armour Chemical Division, where until recently he was sales manager of the Fatty Acids Department.

Mathieson Farm Projects

A 160-acre tract of land has been made available to the University of Houston by Mathieson Chemical Corp., Baltimore, for use as a demonstration farm. The land will become a "clinic" for training agriculture students, with any profits from the project used to finance working scholarships. At the same time, the farm is expected to demonstrate methods for profitable farming in ordinary Texas coastal soil.

The tract is located in Pasadena, Texas, convenient to the University, and adjacent to Mathieson's fertilizer plant. It will be operated by the agriculture department of the University for the nominal rent of \$1 per year.

Attapulugus-Edgar Merge

The businesses of Attapulugus Minerals & Chemicals Corp., Philadelphia and Edgar Brothers Co. were merged recently. The combined corporate operations are now conducted under the name of Minerals & Chemicals Corporation of America.

Stauffer Advances Klee

Harold J. Klee has been appointed manager of the newly-organized central sales division, Stauffer Chemical Co., Chicago. The Stauffer central sales division has district sales offices in Chicago and Houston. Mr. Klee was formerly manager of the Chicago sales district and will con-

tinue to make his headquarters in Chicago. Mr. J. H. Begley, formerly assistant manager, has been appointed manager of the Chicago sales district.

CCDA Elects Sommer

Dr. N. B. Sommer, manager of American Cyanamid Co.'s new product development department assumes the post of presidency of the Commercial Chemical Development Association following his election at a recent meeting in New York. He succeeds Dr. W. E. Kuhn of The Texas Co. The Commercial Chemical Development Association is a national organization of chemical industry development personnel. A meeting is announced for September 12th at the Hotel Statler, New York.

Cotton Foundation Awards

Three farm educational workers will receive \$2,500 fellowships this fall from the Oscar Johnston Cotton Foundation. The awards are a part of the Foundation's continuing program to assist Cotton Belt extension services in improving farmer education by giving advanced training to workers who demonstrate exceptional capacity for leadership.

The awards will go to: Cecil A. Parker, John P. Underhill, and Norvel E. Thames. All three men will study extension program development and administration, as well as agricultural economics.

Mathieson-Olin to Merge

Stockholders of Olin Industries, Inc. and Mathieson Chemical Corp. voted in meetings last month at East Alton, Ill. and Saltville, Va. to approve the merger of the two companies to form a new corporation, Olin Mathieson Chemical Corporation. The new company will be one of the nation's important diversified processing and manufacturing enterprises with total asset of about \$500,000,000 and sales of over \$500,000,000.

Both meetings also passed a restricted option plan for executives of the new corporation, to be substituted for similar plans previously in effect in the two companies.

The exact date upon which the merger will become effective will be announced shortly, according to John M. Olin, president of Olin Industries and Thomas S. Nichols, president and chairman of Mathieson. After the merger, Mr. Olin will become chairman of the board of Olin Mathieson and Mr. Nichols will become president. John W. Hanes, financial vice president of Olin, will become chairman of the finance committee of the new corporation.

Geigy Names Jones

Geigy Agricultural Chemicals, New York announced the appointment of Harold B. Jones as sales representative in the state of Mississippi. He will be located at Leland where Geigy maintains a sales office and formulating plant. He has held many important assignments including that of agricultural specialist with the University of Tennessee Extension Service from 1945 to 1951 after which he supervised the Office of Price Stabilization at Memphis from 1951 to 1952.

Vulcan Expands Operations

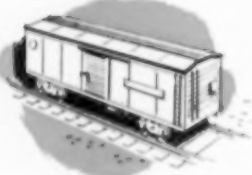
Vulcan Steel Container Co., Birmingham, Ala., announced recently plans to expand its present building to increase operations by about 30 per cent. Vulcan manufactures a full line of sizes of steel pails, from 1 to 8 gallons, open head and drum type, hi-bake lined and lithographed.

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Ostermayer Receives Award

Robert W. Ostermayer, president of Pennsylvania Industrial Chemical Corp., Clairton, Pa., was one of the recipients of the Distinguished Alumnus Award of Pennsylvania State University. Dr. Milton S. Eisenhower made the presentation. Each year the award is presented to five alumni "whose personal life, professional achievements, and community service exemplify the objectives of The Pennsylvania State University."

Following graduation in 1917 from Penn State, Mr. Ostermayer



R. W. Ostermayer Dr. M. S. Eisenhower

was associated for five years with DuPont as a chemical engineer. In 1922 he joined Pennsylvania Industrial Chemical Corp. and two years later became president.

CSC Advances Three

Geoffrey H. Snider has been named manager of the Boston district office of Commercial Solvents Corp., succeeding James A. Farley, recently named field sales manager. Mr. Snider has been associated with CSC since 1925, and since 1947 has held the post of manager of the company's Louisville (Ky.) district office. Replacing Mr. Snider at Louisville is J. H. Brinton Marple, currently attached to the New York sales office. Arthur F. Williams succeeds Mr. Marple.

Bergman, Grantz Named

Carl A. Bergman, technical manager of the textile chemicals section of Antara Chemicals, a sales division of General Aniline & Film Corp., New York, has been appointed assistant manager of chemicals at Antara's Charlotte, N. C., branch, covering the southeast territory. He will be succeeded by Dr. George M. Grantz, research coordinator for textile chemicals at GAF's Central Research Laboratories, Easton, Pa.

Gandrud Open House

Exhibition of the E. Gandrud three hopper fertilizer spreader and seeder was scheduled for an open house on July 20th at E. S. Gandrud Co., Owatonna, Minn. The program also included a barbecue and entertainment.

Guest speakers on the program were Martin E. Weeks, TVA, Knoxville;

A. P. Sale, Cooperative Fertilizer Service, Richmond; Harold Jones, University of Minnesota, St. Paul; and G. D. Scarseth, American Farm Research Association, Lafayette.

Arend Succeeds Harley

George T. Harley, for 10 years manager of International Minerals & Chemical Corporation's potash mines at Carlsbad, New Mexico, retired on July 1. Carl Arend succeeded Mr. Harley as active manager of the installation in January of this year, and since that time Mr. Harley has served as special consultant and advisor for the operation.

Upon his retirement Mr. Harley, who has long been known in the Carlsbad area for his active participation in community and educational affairs, plans to engage in private practice as a geological and mining consultant.

California Safety Booklet

The June issue of *Agricultural Chemicals* contained several illustrations from the California state booklet "Look Out for Yourself . . .", and indicated that it was issued by Monsanto Chemical Co., St. Louis. We wish to correct this statement, as the booklet is actually put out by the California Department of Industrial Relations, Division of Industrial Safety, 965 Mission St., San Francisco. Requests for copies should be directed to the California department. We regret this error.

To Distribute Belgian Fertilizer

Nitrogen Division, Allied Chemical & Dye Corp., early last month became sole distributor in the United States for ammonium nitrate-limestone fertilizer produced in Belgium.

This type of granular fertilizer has had favorable acceptance for many years in the United States, where it has wide general use as a nitrogen top dressing material. It contains 20.5% nitrogen, combined with limestone, which makes it a non-acid forming fertilizer.

The Belgian fertilizer will be stored at leading Eastern Seaboard and Gulf ports. It will be sold through regular nitrogen marketing channels by the Division's present staff of sales representatives.

Anglo-Lautaro Elects

John A. Peebles was recently elected president of the Anglo-Lautaro Nitrate Corp., succeeding H. R. Graham, who retired. J. Vidal became first vice president and general manager, and A. Van de Maele was elected a vice president in New York and a director.

Arkell Buys Hudson Plant

Arkell and Smiths, Canajoharie, N. Y., and Union Bag & Paper Corp., New York, have signed an agreement under which Arkell and Smiths have purchased the Hudson Falls, N. Y., bag plant formerly operated by Union Bag & Paper Corp., and Union Bag continues to act as a selling agent for that plant. The agreement became effective July 1.

The purchase does not include the Honeycomb operation, the product development research laboratory or the machine shop which will continue to be operated by Union Bag.

Berry, Space, Elected

J. C. Berry, Louisiana Liquid Fertilizer Co., and J. A. Space, Jr., Johnson, Lane, Space & Co., were elected directors of Chemical Enterprises, Inc., New York, which is engaged through its affiliated companies in the distribution and application of commercial fertilizers, with particular emphasis on anhydrous ammonia.



SYSTOX*

accepted for use on

APPLES

SYSTOX has been accepted nationally for use on apples for the control of Green Aphid, Rosy Aphid, Wooly Aphid, Clover Mite, European Red Mite and Two-Spotted Mite.

* REGISTERED TRADEMARK OF CHEMAGRO CORPORATION

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Weed Control Officers

Because of the number of requests concerning the officers and representatives of the regional weed control conferences, we have listed below the officers of the national and regional conferences:

Officers of Association of Regional Weed Control Conferences:

President—R. H. Beatty, American Chemical Paint Co., Ambler, Pa.
Vice President—W. B. Ennis, Jr., Section of Weed Investigations, Mississippi State College, Miss.
Secretary-Treasurer—W. C. Shaw, Section of Weed Investigations, Beltsville, Md.

Officers of the four regional weed control conferences are listed below:

Western Weed Control Conference (WWCC)

President—W. S. Ball, State Dept. of Agriculture, Sacramento, Calif.
Vice-President—W. A. Harvey, Agri. Extension Service, Univ. of California, Davis, Calif.
Secretary-Treasurer—W. C. Robocker, Univ. of Nevada, Reno, Nev.

North Central Weed Control Conference (NCWCC)

President—Oliver C. Lee, Purdue University, Lafayette, Ind.
Vice-President—B. H. Grigsby, Michigan State College, East Lansing, Mich.
Secretary-Treasurer—F. W. Slife, Univ. of Illinois, Urbana, Ill.

Northeastern Weed Control Conference (NWCC)

President—A. O. Kuhn, Univ. of Maryland, College Park, Md.
Vice-President—J. D. Geluwe, GLF, Soil Building Service, Ithaca, New York.
Secretary—R. J. Aldrich, Rutgers University, New Brunswick, N. J.
Treasurer—D. A. Schallock, Rutgers University, New Brunswick, N. J.

Southern Weed Conference (SWC)

President—W. C. Shaw, Plant Industry Station, Beltsville, Md.
Vice-President—G. C. Klingman, North Carolina State College, Raleigh, N. C.
Secretary - Treasurer—E. G. Rodgers, Univ. of Florida, Gainesville, Fla.

Inquiries as to the availability and cost of Proceedings and Research Reports of the regional conferences should be sent to the various conference secretaries.

Swift Appoints Two

A. E. Huckabee, assistant to the chief entomologist at Swift & Co., in Calumet City, Ind., has been appointed assistant to the manager at the Swift Plant Food Division at Los Angeles.

It was announced also that John B. Gallagher has joined the staff of the Swift & Co. plant food division in Hammond, Ind., as a chemical engineer with the research laboratory.



A. BURKETTE

J. McCONKEY

Lilly Names Execs

Two new executive additions to the staff of the Chas. H. Lilly Co., Seattle, were announced in the appointment of Jack McConkey as general sales manager and Art Burkette as manager of the Ellensburg branch.

"Glyodin," Fungicide Name

The term "glyodin" has been coined as the common name to designate the fungicide 2-heptadecyl glyoxalidine acetate, the active ingredient in Crag Fruit Fungicide 341. The use of this term has been approved by the Interdepartmental Committee on Pest Control, and has been accepted by the American Chemical Society, the American Medical Association and the American Phytopathological Society.

Iceland Fertilizer Plant

A \$7,000,000 ammonium nitrate fertilizer plant, built with U. S. financial help, was dedicated recently near Reykjavik, about 160 miles from the Arctic Circle. The plant is already turning out fertilizer at a rate of 22,000 tons a year.

IMC Advances Wilson

James A. Wilson, former manager of International Minerals & Chemical Corp.'s Bonnie, Florida, plant, has been advanced to the position of production manager for the Phosphate Chemicals Division. Neil O'Donnell, who has been acting superintendent of the Bonnie plant for several months, becomes plant superintendent.

At the same time, it was announced that Leonard W. Gopp has joined the Phosphate Chemicals Division as special products sales man-

McConkey was formerly manager of the fertilizer department of the Seattle office of Balfour, Guthrie & Company for three and a half years. He will direct the wholesale dealer sales activities of the Lilly Company and its seven Pacific Northwest branches.

As manager of Lilly's Ellensburg branch, Burkette will be in charge of sales in the Kittitas Valley, Yakima and Columbia Basin areas of Eastern Washington. He has been for seven years in charge of the fertilizer and insecticide division of Galbraith & Co., Seattle. Prior to that he was with Sherwin-Williams insecticide division in Seattle.

Mr. Gopp has, until recently, been head of a chemical distributing company of his own, the Philgo Chemical & Products Corp. Prior to that he was assistant general sales manager of Michigan Chemical Corp.

Raymond Lab Director Dies

Mr. W. O. Hinkley, director of the testing laboratory of the Raymond Division of Combustion Engineering, Inc., Chicago, died unexpectedly at his home June 8th. He had been with Raymond Division for seventeen years.

Nitrogen Division Prices

Nitrogen solution contract prices for the fertilizer year July, 1954 to June, 1955, have been announced as follows by Nitrogen Division, Allied Chemical & Dye Corp., New York:

Effective July 1, for the period July-August, 1954, \$126 per net ton of nitrogen, f.o.b., Hopewell, Va., and Southpoint, Ohio. For the period September-October, \$128 per ton of nitrogen. For the period November-December, \$130 and for the period January, 1955, to June, 1955, \$132. These prices compare with the previous price of \$128 per net ton of nitrogen.

V-C Div. Moves Offices

The Bag Division of the Virginia Carolina Chemical Corp. has moved its office to 99 Park Avenue, New York City.



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FUMIGANT

FOUR REASONS FOR USING METHYL BROMIDE

IT'S EFFECTIVE. Pestmaster* Methyl Bromide kills the adults, eggs and larvae of a wide range of insects. It destroys rats and other rodents. Provides simultaneous control of insects, weed seeds, nematodes and certain fungi for soil fumigation.

IT'S ECONOMICAL. Methyl Bromide is easy and economical to use. Only a fraction of the quantity necessary with other fumigants is used because of its unusually high penetrating power. Applied directly from the container, it will reach and kill insects deep within storage bins, packages, bales and bags. Available in a range of cylinder sizes.

IT'S THOROUGH. Insects or rodents do not revive. It is safe for use on a wide range of grains, fresh and dried fruits, shrubs, meats, processed foods and other perishables.

IT'S DESIRABLE. Methyl Bromide is non-explosive and non-inflammable. It is non-corrosive to metals and non-injurious to fabrics. It leaves no residual properties in foodstuff or food products. It can be used in boxcars, warehouses, storage vaults, indoors and out-of-doors.

If your problem is in growing, storage or processing of grain, fruit, meat, dairy products, tobacco, cotton, peanuts or other foods, you will find that Methyl Bromide is the ideal fumigant. An authoritative 16-page brochure on the use and application of Methyl Bromide for various fumigation problems is available on request. Write for Pestmaster* Fumigation Manual.



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Garden Supply Trade Show

Revised dates for the 1954 and 1955 Garden Supply Trade Shows, held throughout the country have been announced as follows:

Western States Garden Supply Show
Exposition Building
Oakland, California

September 19-22, 1954

Middle States Garden Supply Show
Hotel Sherman
Chicago, Illinois

January 9-12, 1955

Eastern States Garden Supply Show
71st Infantry Regiment Armory
New York, New York

January 31 - February 3, 1955

This will be the first year that the public will be admitted to the expositions. Attendance in former years has been limited to members of the Garden Supply trade.

Bagpak Office in Ohio

International Paper Co. has opened a new branch sales office in Cincinnati, Ohio. The new office is located in the Dixie Terminal Building, 49 East 4th Street. It will house representatives of three of the company's principal sales and converting divisions, the Southern Kraft Paper and Bag Division, the Bagpak Division and the Single Service Division.

F. M. Surgene will represent the Southern Kraft Paper and Bag Division, James Woodrow will represent the Bagpak Division, and J. H. Aydlett, the Single Service Division.

IMCC Personnel Changes

Sam B. Broyles advanced from sales representative to district sales manager at Greeneville, Tenn., to succeed J. Hampton Hyder, retired.

P. Lewis Webb advanced to superintendent of Hartsville, S. C. plant to succeed I. R. Timmons, retired. James K. O'Cain succeeds his father, J. P. O'Cain as superintendent of Mulberry, Florida, plant.

Robert L. Wright advanced from district credit manager to district sales manager at Cincinnati, O., replacing Jack K. Lindsey who is being transferred to the Potash Division as district sales manager at Shreveport, La.,

replacing the late Henry C. Aaron. John E. Meister, formerly sales representative, is advanced to district credit manager at Cincinnati.

N S C Studies Fertilizer Safety



Charles Nelson

A motivation study among workers in the nation's fertilizer plants will be made by the National Safety Council. Charles W. Nelson, director of research and planning for the University of Chicago's Industrial Relations Center will direct the project. The purpose of the motivation study is to obtain actual field data on the learning processes, motivations and work habits of the average fertilizer worker. The research project has the support of the American Plant Food Council and the National Fertilizer Association. Paul T. Truitt, president of the council, and Dr. Russell Coleman, president of the association, have expressed the conviction that the study will be a contribution of vital importance to fertilizer management since it will serve to point up specific needs of the industry for safety teaching and worker motivation.

Weisberg Retires from Geigy

Geigy Chemical Corp., New York, announced last month the retirement of Mr. Mark Weisberg, formerly in charge of its Alrose Chemical Co. Division in Cranston, Rhode Island. Mr. Weisberg founded Alrose in 1935. After its acquisition by Geigy in 1949 he continued as its president until it became a division of Geigy on March 30 of this year. During his association with Alrose he was largely responsible for the development of many new products of significance to both the chemical and non-chemical industry.

Alrose, which produces and sells organic chemicals and specialties, is currently expanding its plant facilities for the manufacture of new products including petroleum additives, corrosive inhibitors, "Phenidone" ®, a new photographic developer and amino acids. Alrose products are sold by Geigy Industrial Chemicals, a newly formed division of Geigy Chemical Corp., with headquarters in New York City.

TVA Discontinues Super Prod.

Martin E. Weeks, assistant director of TVA's Division of Agricultural Relations, told a group of farm experts at Owatonna, Minnesota on July 20th that TVA plans to discontinue the production of concentrated superphosphates in 1955, and to devote its energies to the development and introduction of other pioneering types of fertilizer materials. Mr. Weeks attended a demonstration of a new fertilizer spreader which mixes straight materials, and applies them in whatever proportion the crop being fertilized requires.

TVA plans include continued production of calcium metaphosphate, which contains about 62 percent available phosphate, and experimenting with nitrogen phosphate mixtures of varying analysis, including diammonium phosphate 21-54-0, and other products.

Aircraft Spraying of Insecticides

Applying insecticides from aircraft is the subject of a new Farmers' Bulletin, the U. S. Department of Agriculture announced last month. The bulletin, non-technical and easy-to-read, is the first of its kind to tell the farmer and the spray-plane pilot what they need to know to get best results in killing crop-destroying insects by aerial spraying.

"How to Spray the Aircraft Way" gives farmers a basis for appraising the value of aircraft spraying, and tells how to plan spraying jobs to suit individual needs. It gives spray-plane pilots information about such matters as equipment, aircraft performance, safety, and calculating pesticide mixtures.

For the spray-plane pilot, formulas and charts give information on aircraft performance, spray formulation, and acreage calculation. Safety pointers, legal aspects of spraying, and plane and helicopter equipment such as tanks, pumps, booms, and nozzles, are discussed.

The bulletin (No. 2062) was prepared by Agricultural Research Service's Aircraft and Special Equipment Center, and may be obtained from the office of Information, USDA, Washington, D. C.



FALL application is gaining in popularity

Get set for a bigger demand this season

AGRICULTURAL authorities, extension services, and farm publications are now pushing fall fertilizer application. And more and more farmers are getting on the bandwagon. Fall application of nitrogen has been found to speed up the breakdown of organic matter in the soil and to get crops off to an earlier, faster start in the spring. Of course, the success of fall fertilizing demands the ammonia form of nitrogen that will not leach out during the long winter.

That's why USS Ammonium Sulphate is so highly recommended as the nitrogen source. It doesn't leach out, but is there in the spring when

the plants need it. In addition, USS Ammonium Sulphate is popular with farmers because it's free-flowing . . . won't cake and clog equipment and is less corrosive. That makes it an easy mixer too.

It's available in bulk for mixing, or in sturdy, moistureproof 100 pound bags for sale for direct application. USS Ammonium Sulphate will not set up in storage.

Don't miss out on this big, new and profitable opportunity. Check your stocks today and, if your supply is low, call our nearest coal chemical sales office for prompt delivery.

USS AMMONIUM SULPHATE



UNITED STATES STEEL

**Cleghorn
Executive V. P.**

A. E. Cleghorn has been named Executive Vice-President, National Aniline Division Allied Chemical & Dye Corporation, New York. He joined Allied Chemical in 1933, and has been with National Aniline Division since 1952.



successively as assistant to the president and vice-president.

Columbia-S. Enters NH₃ Field

Construction work on an ammonia producing plant is underway at Columbia-Southern Chemical Corporation's chemical manufacturing operation in Natrium, Va. Design and construction of the new facility is under the supervision of the Chemical Construction Co. The \$3,000,000 plant is expected to be in production by April 1955. It will mark Columbia-Southern's entry into the ammonia production field.

Velsicol Appoints McCready

W. K. McCready has been appointed director of manufacturing by Velsicol Corp., Chicago. Mr. McCready, who joined Velsicol in 1950 and rose to manager of the Memphis plant, now assumes direction of all manufacturing.

Richard R. Schwankl has been appointed assistant director of manufacturing with headquarters at the Velsicol general offices and laboratories at Chicago. Schwankl started with the firm 7 years ago.

Bagpak Ofc. in Des Moines

The Bagpak Division of International Paper Co., New York, is opening a new sales office in Des Moines, Iowa for the sale of multi-wall paper bags throughout parts of Iowa, South Dakota and Missouri. Mr. Dale Rowe will head the new office.

George A. Burroughs Dies

George A. Burroughs, 31, of the Washington, D. C. law firm of Sellers & Conner, died as the result of a drowning accident in the Potomac River, near Washington, sometime during the night or early morning

of July 10-11. Mr. Burroughs specialized in product liability and did state legislature work on bills relating to insecticides, fungicides, rodenticides, etc. with John D. Conner, partner in Sellers & Conner. Mr. Conner is Washington legal counsel for the Chemical Specialties Manufacturers Association and also represents the National Agricultural Chemicals Association.

Mr. Burroughs is survived by his widow, Mrs. Mitzie Lou Burroughs; two young daughters, Gale and Mary Marsha; and his father and mother.

Palm Addresses Niagara Div.

Dr. C. E. Palm, Cornell Univ., Ithaca, N. Y., last month addressed the Niagara Chemical Division of the Food Machinery and Chemical Corp., Middleport, N. Y., and later the Rotary Club at Medina, N. Y., and discussed the problems and future of entomology, and the role of insect control in human welfare.

Dr. Palm indicated that in the teamwork of the entomologist, the farmer, and industry, lies our ability to control effectively our insect enemies; to be prepared to feed 190 million people in 1975 as compared to our present 151 million; and to produce perfect vegetables and fruits. As the result of this teamwork, he feels it will eventually play a vital role in raising the habits and living standards of the people in underprivileged areas, and in turn will contribute to relieving world tension.

Inasmuch as this is the 100th year of the practice of entomology Dr. Palm outlined the growth and development of the entomology profession. He discussed the many methods for insect control that have evolved during the past century, the most important being through the use of chemicals, which dates back to 1867 when Paris green was first used for the control of Colorado potato beetle, only to be followed by many other chemical developments; namely, lead arsenate, calcium arsenate, and oil emulsions. However, Dr. Palm said that with the discovery of the insecticidal properties of DDT in 1942, we began an era which might

US Steel May Produce NH₃

United States Steel Corp., Pittsburgh, is reported to be studying plans to market anhydrous ammonia, which will be produced as a by product from coke oven gases. Currently under consideration is the determination of the most economical method of gas recovery.

U. S. Steel is expected to make a decision on its proposed plans for ammonia production in a few months. The first installations, if made, will be at plants in Gary, Ind. and Geneva, Utah.

be called the most significant decade of insect control during the past 100 years of professional entomology. The synthesis of organic insecticides, with far greater capacity to kill insects than anything previously known, ushered in an expansion in control programs far beyond the fondest hopes of entomologists up to that time. Many new synthetic insecticides such as benzene hexachloride, chlordane, toxaphene, aldrin, and many others came into being shortly thereafter, and Dr. Palm gave credit to the European scientists who discovered the insecticidal value of DDT and BHC for initiating this new era, as well as our own chemists who made valuable contributions in this direction. In spite of the importance of all these new chemicals, Dr. Palm stressed quite emphatically the role of the beneficial insects, which can be maintained, if the new synthetic pesticides are used intelligently.

He went on to say that the problem of resistance to chemicals is not new, but is the most challenging problem of our time. Unless science can solve this problem satisfactorily, we shall be shifting our pesticide practices rather constantly from one chemical to another in the field of pest control. However, Dr. Palm looks optimistically to the future since he feels that the cooperative and combined efforts of the entomologist, the farmer, and industry, will cope with and solve the present and future problems even better than in the past.

STURTEVANT MICRONIZER* GRINDING MACHINE



*Grinds Insecticide
Compounds
to Any Size
Specifications*

24" Size
Capacities 1000
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per hour



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Here's the new, improved Sturtevant Micronizer Grinding Machine that is engineered to grind insecticide compounds to any size specification, at high production speeds.

It is quickly and easily cleaned on changes of formulation with minimum loss of material. Simple to install and operate. It is available as a machine alone . . . or as a complete grouping with premixing, grinding and bagging equipment. Write for complete information, today.



Sturtevant Dry-Batch Mixer for mixing materials into a homogeneous mass. 5 models: 1/4 to 2 tons.

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New Package Design

Smith Agricultural Chemical Co., Columbus, O., are distributing their line of "SACCO Soluble Plant Food"



in a new family packaging design for four different packages. The different applications consist of a point-of-sale display carton, a small carton containing foil packets, and a large label can. Full color reproductions of fruits and vegetables illustrate the cartons.

'53 Potash Output Up 13%

The domestic production of marketable potassium salts again reached a new high in 1953, increasing more than 13 per cent above the 1952 production, according to reports by producers to the Bureau of Mines, United States Department of the Interior. Sales and apparent consumption of potassium salts both increased in 1953, 8 per cent and 4 per cent, respectively, as compared to 1952. Stocks in producers' hands at the end of 1953, more than double the 1952 figure, were 470,051 short tons with K_2O content of 278,508 tons.

Both imports and exports of potash materials were less in 1953. Imports totaled 253,113 tons (130,362 tons K_2O) compared with 357,437 tons (188,441 tons K_2O) in 1952. West Germany, East Germany, France, Spain, and Chile, respectively, supplied 34, 21, 20, 17, and 5 per cent of the total United States imports of potash. Exports of potash materials totaled 88,208 tons, 13 per cent less than in 1952 with the major portion going to countries in the Western Hemisphere.

The production of both high-grade muriate (60-62 percent K_2O) and sulfate of potash (including

sulfate of potash magnesia) increased in 1953, 19 and 6 percent, respectively. Production of the lower grade muriate (48-50) per cent K_2O) and manure salts was considerably less in 1953.

New Mexico, California, and Utah continued to supply the major portion of the domestic production, with New Mexico supplying 90 per cent. The potash producing companies in the United States in 1953 were the same as during 1952.

Prepared by E. Robert Ruhlman, Commodity-Industrial Analyst, and Gertrude E. Tucker, Statistical Assistant, under the supervision of W. F. Dietrich, Chief, Ceramic and Fertilizer Materials Branch, Minerals Division, Bureau of Mines, Washington 25, D. C., May 1954.

CCA Bulk Spreading Plan

Active educational programs by many farmer cooperatives are helping to popularize the bulk spreading of fertilizer by farmers. The economies and advantages of bulk fertilizer were discussed in a recent series of meetings and demonstrations staged by Consumers Cooperative Association of Kansas City, Mo. Dean McCammon, manager of the big farm supply association's fertilizer department, was in charge.

Meetings were held at Eagle Grove, Ia., St. Joseph, Mo., and Muskogee, Okla., locations of CCA's three fertilizer mixing plants. Some 25 to 35 local co-ops were represented.

John Miller, CCA soil conservationist, explained at each meeting the part the co-op manager can play in helping farmers with their fertilizer problems, by advising them as to proper time and rate of application. McCammon cited figures on the average amount of fertilizer used per farm in the nine states served by CCA, the average amount sold by co-ops, per farmer, and the recommended amount that should be used to maintain soil fertility. If recommended amounts were used, he asserted, the potential volume of fertilizer sold by the local co-op would run from 3 to 18 times actual 1953 figures.

At the St. Joseph, Mo., meeting, Odus Clevenger, manager of Consumers Oil & Supply Co., Braymer, Mo., told how he increased fertilizer

Conn. Staff Appointments

Three new appointments to the research staff of the Connecticut Experimental Station have been announced. Dr. S. L. Wilson and Dr. Milton Zucker have joined the Station's Plant Pathology Department, and Dr. Lester Hankin has been appointed to the Biochemistry Department staff.

Davison Office in Texas

Davison Chemical Co., Div. of W. R. Grace, opened a new office in Houston last month. John Benedict and C. V. Bolles were transferred to the new office.

sales by contracting with a local trucker to haul bulk material from the St. Joseph mixing plant direct to patrons' farms. This, he said, resulted in no decreased volume of bagged fertilizer sales and had reduced labor costs both for the co-op and the individual farmer.

Another speaker, James Cline, manager of Consumers Oil Co., Maryville, Mo., said he had been providing a bulk spreading service for two seasons, with definite increase in sales volume.

Following the discussion sessions, the groups adjourned to nearby farms where bulk spreading jobs were in progress. At the R. D. Faucett farm, ten miles north of St. Joseph, equipment was demonstrated which could accurately apply as low as 75 pounds of material per acre. Here only 40 minutes were required to apply 250 lbs. per acre on 15 acres. The spreader trucks, it was also learned, had been driven up to 30 miles per hour on large, level fields, applying fertilizer at the desired rate.

Demonstrated also was an example of how an 18 to 20 ton truck can haul fertilizer from the warehouse to distant points, at which smaller trucks, equipped for the fertilizer application, can be loaded, providing the bulk spreading service to co-ops and farmers who are a considerable distance from the fertilizer mixing plant.

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ORTHO LINDANE more than meets government standards

ORTHO Lindane 100 is actually purer than the minimum government standards—has a minimum gamma isomer of 100% . . . highest potency . . . combines effectiveness with economy.

Easy to formulate

ORTHO Lindane is easy to handle and formulate as a spray or dust. The crystals are dry and free-

flowing, easily ground to micro-size.

ORTHO Lindane may be purchased in prepared formulations under the ORTHO brand name of ISOTOX. A variety of ISOTOX formulations in liquid, wettable and concentrate form is available.

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SCIENTIFIC PEST CONTROL

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AGRICULTURAL CHEMICALS

NEWS *Brevities*

THE NATIONAL FERTILIZER ASSOCIATION has a new editorial assistant—Peter C. Crolius, a recent graduate of Cornell University's Department of Extension Teaching and Information. Mr. Crolius is assisting Delbert L. Rucker, NFA director of information. He is a veteran of the Army during World War II and of the Navy in the Korean War. He was associated with the Army Information and Education program and the Navy Public Information Office while in the service.

W. GRANT KILBOURNE, vice president of J. R. Simplot Co., has been named general manager of the fertilizer division of the company. He will direct production, mining, sales and distribution of materials with headquarters at Pocatello, Ida.

TREVOR STEELE, Pacific Northwest regional agronomist for American Potash & Chemical Corp., has moved his headquarters from Des Moines, Wash., to Salem, Ore.

HAROLD J. KLEE is manager of the recently organized central sales division of Stauffer Chemical Co., with headquarters in Chicago.

RICHARD A. BROWN has been elected president of the Dickerson Co., Inc., according to an announcement from the board of directors.

WOODROW W. WIBEL has been appointed to the sales department of Jameson Chemical Co., Chicago, according to A. R. Jameson, president.

TWO PLANTS at Delaware, O. and Chicago Heights, Ill., will be built by Pennsylvania Salt Manufacturing Co. as units in its chemical

specialties division, headed by Albert H. Clem. The plants will serve as regional blending and packaging

centers for chemical specialties, including some pesticides.

ALL SALES activities for Hammond Bag and Paper Co. in Michigan soon will be handled from Chicago, with J. E. Cornell Jr. and W. A. Sheets representing the company.

ATLAS POWDER CO. has appointed Edward J. Goett director of the new commercial development department of the company, according to Ralph K. Gottshall, president.

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If you use Zinc Sulphate be sure to check

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Non-irritating to Workmen

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Agricultural Chemical Specialists

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Cash in on

liquid nitrogen solution boom

with new BUTLER aluminum TANKS

Welded low-pressure skid tank for on-farm storage. Available in 500, 830 and 1000-gallon capacities. Others (without skids) from 100 to 1000 gallons.



Liquid nitrogen solution fertilizers are sweeping the country! More and more farmers are applying nitrogen this new, fast, low-cost way. This is your chance to get in on the ground floor of a booming market—and profit as demand soars!

Butler now offers two types of special alloy non-corrosive aluminum bulk storage tanks for nitrogen solutions: (1) Bolted vertical 22,000-gallon tanks for non-pressure solutions; (2) Welded horizontal 12,000 and 22,000-gallon bulk storage tanks for low-pressure solutions.

Smaller size horizontal aluminum tanks in 100, 270, 500, 830 and 1000-gallon capacities are also available. The 500, 830 and 1000-gallon tanks can be factory-equipped with skids for on-farm storage or transporting solutions from bulk station to farm.

Act now and cash in! Send coupon today for full information.



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AGRICULTURAL CHEMICALS

INDUSTRY *Patents*

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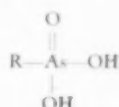
LANCASTER, ALLWINE & ROMMEL

402 Bowen Building
Washington 5, D. C.

The data listed below is only a brief review of recently issued pertinent patents obtained by various U. S. Patent office registered attorneys for manufacturers and/or inventors. Complete copies may be obtained direct from Lancaster, Allwine & Rommell by sending 50c for each copy desired. \$1.00 for Canada. They will be pleased to give you free preliminary patent advice.

2,676,881. **HERBICIDAL COMPOSITIONS.** Patent issued April 27, 1954, to George E. Bennett, Dayton, Ohio, assignor to Monsanto Chemical Company, St. Louis, Mo., a corporation of Delaware. The method of destroying undesirable plants which comprises applying to said plants a toxic quantity of a herbicidal composition comprising a ketone selected from the class consisting of 2-(1-cyclohexenyl) cyclohexanone and 2-cyclohexylenecyclohexanone.

2,678,265. **WEED CONTROL.** Patent issued May 11, 1954, to Arthur Schwerdle, Vineland, N. J., assignor to Vineland Chemical Company, Vineland, N. J. The method of selectively controlling the growth of crabgrass which comprises applying to an area containing crabgrass a composition comprising a mixture of at least one arsenic compound selected from the group consisting of arsenic acids having the formula:



where R is an aliphatic group selected from the group consisting of methyl, ethyl, propyl, allyl and butyl, and salts thereof; and an inert diluent therefor, in a concentration and amount sufficient to destroy crabgrasses but insufficient to destroy material quantities of the useful grasses and plants.

2,678,294. **FUMIGANT COMPOSITION COMPRISING (2-BROMOETHYL) BENZENE.** Patent issued May 11, 1954, to Charles R. Youngson, Long Beach, Cal., assignor to The Dow Chemical Co., Midland,

Mich., a corporation of Delaware. A soil fumigant composition comprising (2-bromethyl) benzene as an active toxic ingredient in intimate association with an aqueous emulsion.

2,678,878. **PLANT GROWTH REGULANTS CONTAINING ARYL AND HALOARYL ESTERS OF ARYL AND HALOARYL SULFONIC AND THIOSULFONIC ACIDS.** Patent issued May 18, 1954, to William D. Stewart, Brecksville, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y., a corporation of New York. A plant growth regulant composition which comprises as the essential active ingredient 0.01% to 10% by weight of a halophenyl ester of halobenzene sulfonic acid uniformly dispersed in an aqueous solution containing 0.01% to 1.0% by weight of a wetting and dispersing agent.

*moly makes the alfalfa grow**



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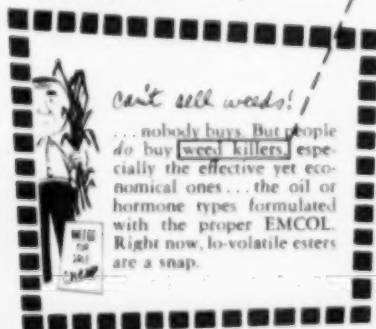
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2,679,453. **METHOD AND COMPOSITION FOR THE CONTROL OF UNDESIRABLE VEGETATION.** Patent issued May 25, 1954, to Charles H. Brett, Raleigh, N. C., and Ernest M. Hodnett, Stillwater, Okla. A method for the suppression of the growth of vegetation which comprises applying to the foliage thereof a growth inhibiting amount of a trichloromethyl substituted pyridine.

Trade Mark Applications

STA-SET, in capitals, for preparation for application to fruit trees and shrubs, preferably by spraying, to improve yield of fruit. Filed Oct. 8, 1952, by Allied Chemical & Dye Corp., New York, N. Y. Claims use since Aug. 12, 1952.

BROWN PATCH, with letters underlined, for preparation for seeding, fertilizing and conditioning soil. Druid Hill Park Seed Corp., Baltimore. Claims use since Sept. 23, 1952.

BIG FRUITER, in capitals, for fertilizers. Filed May 8, 1953, by Smith-Douglass Co., Inc., Norfolk, Va. Claims use since Sept. 16, 1953.

SMITH-DOUGLASS CO. INC., on a background of large letters "SD." For fertilizers. Filed May 8, 1953, by Smith-Douglass Co., Inc., Norfolk, Va. Claims use since Jan. 11, 1928.

MONEY MAKER, in outline letters, for fertilizers. Filed May 28, 1953 by Smith-Douglass Co., Inc., Norfolk, Va. Claims use since Jan. 30, 1929.

MAGGLOR, in bold capitals, for defoliant. Filed Oct. 16, 1953, by United Chemical Co., Richmond, Cal. Claims use since Aug. 20, 1953.

PENTRETE, in capitals, for seed disinfectant composition for protecting seeds and young plants against decay. Filed Oct. 29, 1953, by the Pennsylvania Salt Manufacturing Co., Philadelphia. Claims use since Feb. 20, 1953.

SLO-GRO, with the first "o" in smaller type, for preparation to prevent the rapid growth of grasses. Filed Jan. 21, 1953 by Emery L. Radwany, Milford, Conn. Claims use since Jan. 14, 1953.

KILATHON, in capitals, for insecticides for killing flies and garden insects. Filed Oct. 8, 1953, by William Cooper & Nephews, Inc., Chicago. Claims use since Sept. 23, 1953.

UP-START, in capitals, for fertilizers. Filed April 2, 1953, by California Spray-Chemical Corp., Wilmington, Del. Claims use since March 6, 1953.

CHLOR-GREEN, in script letters, with word "Green" disclaimed apart, for plant food. Filed Dec. 8, 1952, by Centropolis Crusher Co., Kansas City, Mo. Claims use since Nov. 18, 1952.

HORN O'PLENTY, in capitals, for balanced fertilizers. Filed Oct. 9, 1953, by Wm. C. Horn, Inc., Bellevue, O. Claims use since April 1, 1948.

SOILAC, in open letters, for horticultural plant aid. Filed Dec. 16, by F. E. Schundler & Co., Joliet, Ill. Claims use since Oct. 15, 1953.

OTHO-TIL, in open capitals, for soil conditioners and amenders. Filed Aug. 8, 1952, by California Spray-Chemical Corp., Wilmington, Del. Claims use since June 23, 1952.

SIFTER-PAK, in capitals, for dispensing containers filled with granular plant food and soil conditioning product and marketed only in the filled state. Filed March 30, 1953, by Oswego Soy Products Corp., Oswego, N. Y. Claims use since March 13, 1953.

SQUARE DEAL, in open letters, on square area, for fertilizers. Filed May

15, 1953, by Smith-Douglass Co., Inc., Norfolk, Va. Claims use since Aug. 7, 1953.

NITRA-MIX, in capitals and lower case letters, for liquid fertilizer solutions of soil nutrients and conditioners including nitrogen, phosphates and potash. Filed Nov. 2, 1953, by the Nitrogen Co., Inc., Houma, La. Claims use since Aug. 1, 1953.

NITRA-EASE, for aqua ammonia for use as fertilizer. Filed Nov. 2, 1953, by Plantation Chemicals, Inc., Houma, La. Claims use since Aug. 1, 1953.

NITRA-TEX, for aqua ammonia for use as fertilizer. Filed Nov. 2, 1953, by Texas Anhydrous Ammonia Corp., Hitchcock, Tex. Claims use since Aug. 1, 1953.

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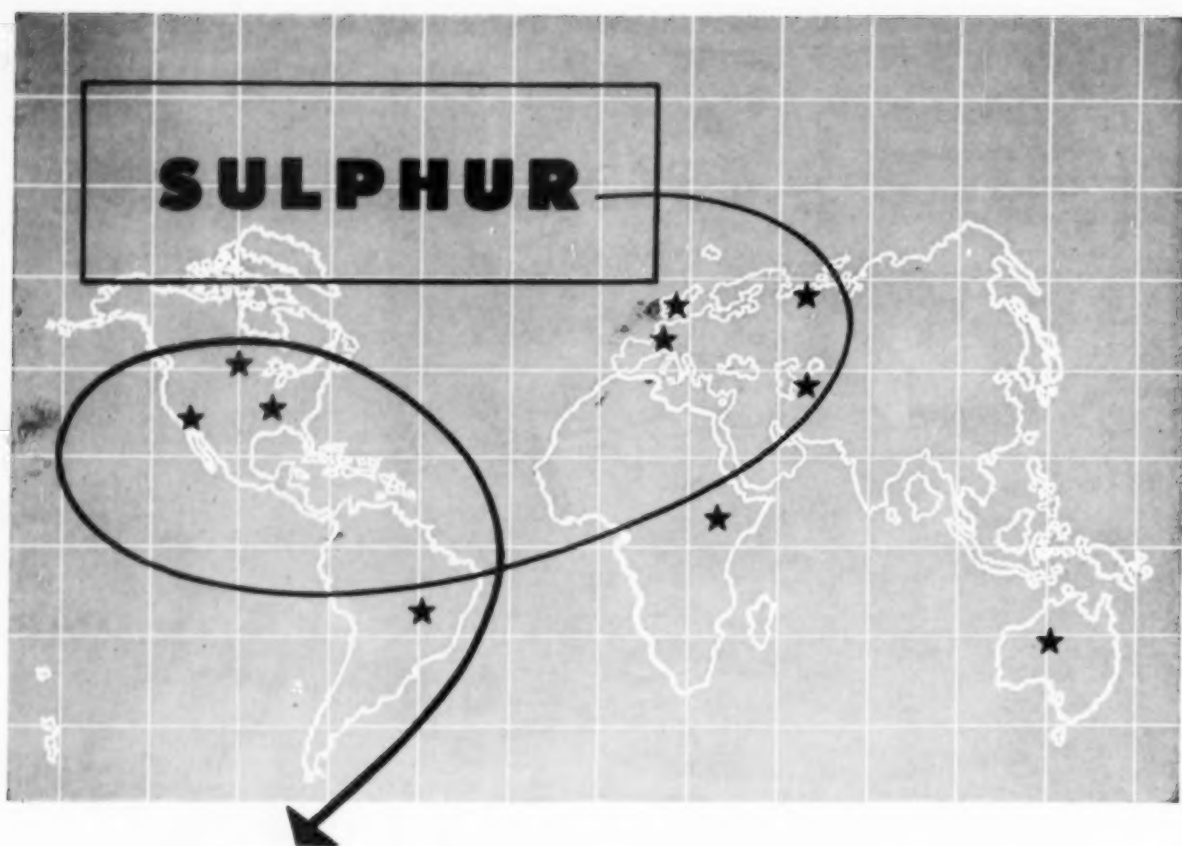
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Although the United States is the largest producer of elemental sulphur, its production is only about one-half of sulphur in all forms produced in the free world.*

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Elemental sulphur, per se, is essential for such compounds as carbon bisulphide, rubber vulcanizing and certain fungicides, insecticides and black powder. Economics dictate the use of the element or the sulphides or sulphate for other products and processes.

*International Minerals Conference, 1952-53

Texas Gulf Sulphur Co.

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Sulphur Producing Units

- NEWGULF, TEXAS
- MOSS BLUFF, TEXAS
- SPINDLETOP, TEXAS
- WORLAND, WYOMING

NEW STICKER

(From Page 50)

serve as an attractant for honeybees, however tests proved this not to be true.

National Sticker is made up of adhesive substances synthesized from sugar dissolved in a solvent (covered by pending patent applications). It is a rather dark, clear solution of two or more insoluble resins in methanol, bitter to the taste. It mixes readily in water, forming a colloidal dispersion, milky in appearance. One quart of the compound contains 0.75 pound of active ingredients. Generally, this is the most practicable usage rate; however, twice the amount was found to be advantageous in certain types of sprays.

Physical specifications of the product are as follows:

Form	dark, clear soln.
Surface tension	29.5 degrees/cm. @20°C.
Spec. grav.	0.928 @20°C.
wt./qt.	1.91 lbs.
wt./gal.	7.65 lbs.
Viscosity	1.055 cp. @20°C.
pH	6.8—7.0
Charge in water dispersion	positive

Solvent	Solubility
Water	
Hot	I
Cold	I
Alcohols	
Ethanol	S
Methanol	S
Butanol	S
Ketones	
Acetone	S
Hexone	PS
Methyl Ethyl Ketone	PS
Esters	
Ethyl Acetate	PS
Aromatic Hydrocarbons	
Benzene	SS
Toluene	PS

Aliphatic Hydrocarbons	Mineral Oil (Nujol)
Heptane	PS
Chlorinated Solvents	I, insoluble; S, soluble; PS, partly soluble;
Carbon Tetrachloride	SS, slightly soluble

Retention of Lead Arsenate (4 lbs. per 100 gals.) by Various Stickers, Newark, Delaware, 1950

Sticker	Rate per 100 Gallons	Micrograms of As ₂ O ₃ Square Inch Deposited	Micrograms Square Inch Retained	Percent As ₂ O ₃ Retained After Washing
Brand #1	1 pt.	35.7	5.5	15.4
Brand #2	2 oz.	29.5	6.7	22.7
Brand #3	1/2 lb.	29.6	7.7	26.0
National	3/4 lb.	36.2	13.0	35.9



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You benefit from our know-how. For we've been supplying raw-material chemicals to industry for 64 years. You'll find the

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order for Wyandotte agricultural products promptly — in the exact quantities you need — directly from our strategically located regional plants and warehouses.

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at all times to give you a hand with the improvement or development of your products — and to provide technical assistance with processing or handling problems.

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GLYCOLS • SYNTHETIC DETERGENTS • AGRICULTURAL INSECTICIDES • SOIL CONDITIONERS • OTHER ORGANIC AND INORGANIC CHEMICALS

MIDWEST MARKET

(From Page 39)

ly want to reach. There will have to be modifications and changes made in your plans along the way to meet current conditions, of course. Soil fertility will put more flexibility for needed changes into your plan than any other item—it could well be called the key to farm progress."

A note of caution is sounded by another banker, O. E. Anderson, secretary, Ohio Bankers Association; "Don't make the mistake of selling a banker on granting plant food loans that are not likely to produce good results. Both you (the manufacturer) and the banker are in business to stay, and repeat business can be gained only by developing mutual confidence.

"It is my firm conviction that both the dealer and banker should know enough about the individual farming practices in their area to recognize whether the type of ferti-

lizer being purchased, the quantity and the cropping practices are apt to produce good results. Without a knowledge of those three conditions, the dealer may be selling the farmer a complete lemon and the banker may as well be pouring his depositors' money into a hectic stock market."

The Role of Irrigation

THE spread of irrigation into areas such as the Mid West where rainfall was once thought to be sufficient is still another move which spells more business for the agricultural chemicals industry. So called normal rainfall used to be sufficient. It is barely enough any more even when it does come in normal amounts and right on schedule.

It's the agricultural chemical industry that is powering the drive to sink deep wells and dam up more streams. By applying more chemical aids, the farmer can push yields up to fantastic levels provided there is plenty of water. It used to be that

the goal of experimental work was 100 bushels of corn. Today it's closer to 300 bushels.

Without debating about which came first, the lighter metals to popularize irrigation, the scientific developments to show us the potential, or the economic necessity in the thinking of some farm leaders—irrigation is here and it's spreading fast. Already it has had an effect on the agricultural chemicals business. It will have more.

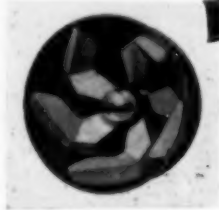
Many areas of the Mid West are ideal for irrigation. The section is one where there is an abundance of underground water. The farm know-how is there, along with an alert, well educated farm population. It looks like the right combination.

While every region of the nation has its advantages and potential, the Mid West looms large in the fortunes of the agricultural chemicals industry, partly because of the situations just reviewed. The region has been slow to develop be-

MIX IT *better* ... MIX IT *faster* ... MIX IT with a ... the **TUMBLING ACTION** mixer for intimate blending of dry ingredients

For intimate, accurate mixing of dry ingredients in the **shortest** time—the Munson Rotary Batch Mixer has proved its value on **hundreds** of different applications. Will not stratify ingredients—will not alter characteristics of basic components. Its famous 7-way mixing action, plus lower horsepower requirements and low operating costs, make the **MUNSON** first choice for performance and economy!

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Miller Bill

Headquarters and meetings will be held at the Essex and Sussex. Reservations for accommodations should be made to Mr. C. S. Krom, Manager of the Essex and Sussex. Accommodations have been reserved also at the nearby Monmouth. For further information regarding the meeting, contact the Executive Secretary of the National Agricultural Chemicals Association, 528 Barr Building, 910 17th Street, N.W., Washington, D. C.

cause of its great inherent soil fertility.

Part of this has been spent. Part has been lost through leaching and erosion which accompany crops production. In this respect the region is coming of age and some of the same trends existing in the older eastern regions of the nation are beginning to show up.

Consider our Iowa farmer again who in a recent year spent slightly over 3 per cent of his gross farm income for fertilizer. Compare this to the expenditure in Pennsylvania of over 14 percent and you have a gap large enough to handle many more agricultural chemical plants.★★

ENTOMOLOGY CENTENNIAL

(From Page 44)

for research into technics for residue analysis and studies of the magnitude of residues in fresh fruits, juice, and frozen concentrates, and even in by-products such as cattle feed, and citrus oils. These methods of investigation have provided a useful pattern for studies with subsequent pesticides. It has been necessary to develop entirely new practices for the protection of the health of spray crews, orchardists, and pickers. However, three years of extensive field use have demonstrated that parathion can be used safely and is of the utmost benefit in citrus pest control. Two newer phosphorus toxicants, malathion and chlordion, offer promise of partially supplanting parathion for many uses, and have the special advantage of being less than 1/100 as toxic to man and animals.

The control of the citrus red mite has also been revolutionized by the successive introduction of 4,6 dinitro-o-cyclohexylphenol and its dicyclohexylamine salt, bis-(p-chlorophenoxy)-methane (Neotran), p-chlorobenzene sulfonate (Ovotran), and 2-chloroethyl-2-p-tert-butylphenoxy isopropyl sulfite (aramite). The last three materials with their low mammalian toxicity, specificity of action, and long period of residual activity have provided nearly ideal mite control and have greatly decreased the frequency of treatment necessary. Aramite and p,p'-dichlorobenzyl acid, ethyl ester (Chlorobenzilate) are effective for control of citrus bud mite.

Tartar emetic-sugar baits provided a cheap and effective control for the citrus thrips, but spreading resistance to this chemical has forced it into disuse. DDT and more recently dieldrin have provided excellent control at 1 to 2 applications per year, the latter material proving effective at 0.5 pounds per acre. Sabadilla extract has also proved of value in controlling this pest.

The newly developed systemic insecticides offer much promise for citrus pest control because of their activity against sucking pests, their long term residual action, their ability to protect new growth forming after treatment, their safety to beneficial insects, and their ability to spread throughout the plants after imperfect coverage. Systox at dosages of 0.5 to 1 pound per acre has provided the best obtainable control of the citrus red mite and citrus aphids. The discovery that this material works nearly as well when applied to the trunks of citrus trees as it does from foliage applications may have far-reaching effects on citrus spray practices. Many other promising systemics are in the offing.

Miscellaneous insecticidal practices which should be mentioned include the use of aldrin, dieldrin, and heptachlor for the control of the Argentine ant in citrus groves, and the development of ethylene dibromide fumigation for the commodity treatment of citrus infested by fruit fly maggots.

Along with the development of new pest control materials have come advances in equipment for their application. The high cost of labor has resulted in the extensive development of mechanized sprayers which have evolved in two directions; air blast sprayers for application of concentrate sprays, and high-pressure multiple-discharge oscillating-boom sprayers for full coverage applications. These devices offer a decided advantage in the utilization of the more hazardous materials, as the operator can easily be protected from contact with the spray. The use of toxicants such as parathion, Systox, and dieldrin which give suitable pest control at rates of 0.5 to 1 pound per acre has opened up new vistas in the use of concentrate sprays, and

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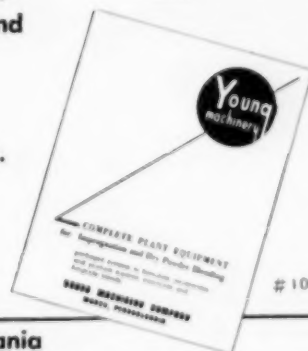


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▲ This newest pest control reference volume deals primarily with household and industrial pests, insects, rodents, etc., their habits, identification, and latest methods of control. It is the most complete work of its kind ever offered in a single volume.

▲ Those who have used the original HANDBOOK by Mallis undoubtedly will want this new, up-to-date volume, a standard reference book which should be in the library of every pest control operator, insecticide manufacturer and marketer, entomologist, chemist and others interested in modern materials and methods of pest control.

▲ The new HANDBOOK of PEST CONTROL by Arnold Mallis measures six by nine inches, has a sturdy binding in green cloth, gold stamped. The book comprises twenty five chapters, running to a total of 1067 pages and is printed on durable, long-lasting paper.

TABLE OF CONTENTS

rats and mice
silverfish
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cockroaches
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wood-, book-boring
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clothes moths
household fumigation
hide and carpet beetles
ants
bees and wasps
stored product pests

spider or ptinid beetles
lice
fleas
flies and mosquitos
spiders
mites
ticks
miscellaneous household
pests and chemicals used
in their control

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AGRICULTURAL CHEMICALS

fixed and rotating-wing aircraft have been successively used for the entire pest control program in limited areas, with decisive advantages in costs and freedom from orchard soil compaction and tree and fruit damage. Selective pruning and hedging practices are currently being developed to increase the efficiency of the concentrate applications.

The above progress report is indicative of the decisive progress which is being made in the control of the insect pests of citrus. However, the resourcefulness of our insect enemies will continue to demand the fullest exercise of entomological endeavor.★★

CALIFORNIA FERTILIZER CO'S.

(From Page 49)

the Coolidge plant. A half interest is owned in the Pinal Grain Co., Casa Grande, Ariz. The fertilizer mixing plant, insecticide plant, the principal feed mill and grain and feed storage facilities are located at Phoenix. Mixed fertilizer is formulated and sold under the brand names "Vita-Crop" and "Vita Mulch". Capital's insecticide line carries the "Capitol" brand. "Capitol" brand poultry and dairy feeds and "Thunderbird" brand sorghum grain seed complete the line. ★★

SOIL FUMIGATION

(From Page 27)

The search for new nematocides has continued, but it has been unexpectedly difficult to find chemicals which can compete with the present ones. Several with interesting possibilities have been reported, but none have reached the market.

The number of new users of soil fumigants, new uses, new materials, improved methods of application and the growing interest in nematodes all add up to indicate that the nematocide industry is still in an early stage of development. Those who have followed its progress from the start to its present state as a multimillion dollar industry which adds many more millions to the value of farm crops believe that the possibilities for growth are unlimited.★★

AUGUST, 1954

FLY CONTROL

(From Page 34)

expect the same biological activity, consequently, only two comparisons of such formulas were made in the field. In treatment "K," using a 1+19 dilution, under conditions of below average fly populations, the piperonyl butoxide-allethrin (10-1) appeared

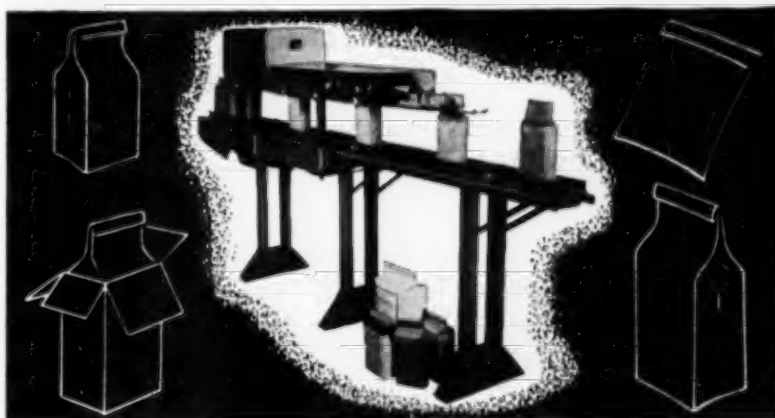
somewhat less effective after the fourth day, and while still exhibiting some control at 10 days, was only about one third as effective as the piperonyl butoxide-pyrethrins (10-1) standard. Under conditions of much heavier populations (Treatment L), the superiority of the standard was even more pronounced. There were ten different experiments

TABLE 3
Laboratory Evaluation of Piperonyl Butoxide-Allethrin and Piperonyl Butoxide-Pyrethrins Emulsions for the Control of Stable Flies, Baltimore, Maryland, 1950

Test	Conc. of Act. Ingre. g/100 ml.				Dilution	Pre- Treat.	Count-Flies/half animal*					Pro- tective Period— Days
	P.B.	All.	Pyre.	1			Days after Treatment					
							2	3	6	7		
A	10	—	1	1/9	—	13	26	50	63	223	2	
	10	2	—	1/9	—	26	49	91	76	229	1	
B	10	—	1	1/19	107	4	11	73	55		2+	
	10	2	—	1/19	100	7	21	67	74		2	

*Counts represent number of stable flies alighting on the treated animal per five minute period.

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in which allethrin was substituted at twice the concentration of the pyrethrins while the piperonyl butoxide was held constant. Six of these comparisons were made at dilutions of 1+19. When pre-treatment counts were less than 100 flies per animal, there appeared to be little difference in the effectiveness of the two formulas, particularly for the first five days of the test. With one exception, as the residual period increased, the pyrethrins combination (10-1) was superior to the allethrin combination (10-2). When populations increased to more than 100/animal, the superiority of pyrethrins became even more pronounced.

There were four comparisons in which the same formulas were used at twice the concentrations (1+9 dilution). In two instances (G & H), the two formulas were about equally effective while in the remaining two experiments, preference was shown for the pyrethrins combination.

Three-way combinations containing 10 gms. of piperonyl butoxide, 0.5 gms. of pyrethrins and 1 gm. of allethrin/100 ml. were compared to the pyrethrins-butoxide standard in two tests (M and N). Again the standard was the more effective of the two formulas.

The period of residual protection for all 2 and 3-way combinations varied from 5 to 12 days depending largely on initial horn fly

TABLE 4
Summary of Field Experiments Comparing Piperonyl Butoxide-Allethrin and Piperonyl Butoxide-Pyrethrins Emulsions for the Control of Horse Flies**, Eastern Shore, Maryland, 1952-53.

Test	Conc. of Act. Ingrid. g/100 ml.			Dilution	No. of Animals Treated	Pre- Treat.	Count-Av. No. Flies/Animal				
	P.B.	All.	Pyre.				Days after Treatment				
A*	10	2	—	1/9	17	6.0	—	0.3	3.1	—	2.4
	10	—	1	1/9	17	6.0	—	0.3	1.3	—	2.6
B*	10	2	—	1/9	10	3.0	0	0.2	0.2	—	2.0
	10	—	1	1/9	10	3.0	0	0.1	0.1	—	1.7
C	10	2	—	1/9	4	2.0	0	0	0	—	—
	10	—	1	1/9	6	2.0	0	0	1.2	—	—
D*	10	2	—	1/9	7	2.0	0.2	—	—	0.4	—
	10	—	1	1/9	8	2.0	0.2	—	—	0.2	—
E	10	2	—	1/9	10	2.0	0	—	—	0.2	—
	10	—	1	1/9	10	1.7	0	—	0	—	—

*Animals in treatments A, B and D showed an increase in milk production of 2 lbs/animal/day.
***Tabanus atratus* predominating.

populations. On the basis of the data and the observations, it would appear that at least two units of allethrin would be required to equal the performance of one unit of pyrethrins, when each was combined with 10 units of piperonyl butoxide.

b. Stable Fly

Two tests were conducted comparing emulsifiable concentrates of piperonyl butoxide-pyrethrins (10-1) and piperonyl butoxide-allethrin (10-2), the results of which are given in Table 3. In both cases, the former was the more effective for the first 2 days of the test. After that, under conditions of heavy fly populations, neither treatment provided satisfac-

tory control. While the number of comparisons was limited, it appeared, as was the case with horn flies, that it would require twice as much allethrin as pyrethrins to provide equivalent protection.

c. Horse Flies (Tabanids)

Results of 5 paired tests are given in Table 4. These horse flies on dairy cattle were principally the large black *Tabanus atratus*, which are severe biters with big capacities for blood and ones that were very annoying even when present in small numbers. For this species, the populations were probably as high as those experienced in many parts of the country, and under the condi-

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tions the treatment gave excellent control, the protection periods ranging from 4 to 6 days. In three cases, (A, B and D), the herdsman reported that milk production increased about 2lbs./cow from the protection afforded in these tests from horse flies. In general, there appeared to be little difference in the pyrethrin (10-1) and allethrin (10-2) combinations, thus indicating that for the control of this insect, the two for one relationship of allethrin to pyrethrin might be adequate.

d. Gas-Propelled Sprays (Cow Bombs)

The first experiment was designed to determine the influence of percentage of propellant on the effectiveness of the treatment. Results of these tests are given in Table 5. Although all treatment reduced horn fly populations for a period of 7 hours, the one containing 70 per cent propellant appeared to give the most consistent performance. Against stable and house flies, all treatments were rather effective for 5 hours and beyond this time, "J" containing 70 per cent propellant was the most effective.

In table 6 are shown the results of two experiments in which formula "A," containing 0.2 per cent pyrethrins, 2.0 per cent piperonyl butoxide and 3.00 per cent methoxychlor, was compared to formula "H" containing 0.4 per cent allethrin, 2.0 per cent piperonyl butoxide and 3.0 per cent methoxychlor. Unfortunately "A" employed 80 per cent propellant while "J" had 70 per cent. Both formulas provided about 50 per cent protection against stable flies at 4 hours and offered little if any protection after 6 hours. While prior to 4 hours, protection was increased, it was never greater than about 60 per cent, indicating a need for formula improvement for use against this species.

In a separate experiment on calves, the results of which are also recorded in Table 6, both formulas reduced house fly populations about 75 per cent for the first two hours. By the end of 4 hours, there was about a 30 per cent reduction in the fly population.

In Table 7 are summarized the results of several formulas that were compared directly under as

TABLE 5

Influence of Propellant Content on Efficiency of "Cow Bombs" Applied to Dairy Animals for the Control of Horn Flies, Stable Flies and House Flies, Baltimore, Maryland, 1953.

Spray Time per Animal in Seconds	Observation Period After Treatment	Fly Species	Average Number of Flies/Animal Four Consecutive Daily Treatments				
			Percent Propellant**				Untreated
			85	70	50	25	
3	2 Hrs.	Horn Fly	0.8	0.6	0.1	0.7	12.2
	3 Hrs.	" "	0.8	0.0	1.8	0.8	12.1
	4 Hrs.	" "	1.0	0.2	1.9	1.0	9.0
	5 Hrs.	" "	1.3	0.2	2.0	2.4	8.7
	6 Hrs.	" "	1.6	0.5	3.8	2.2	9.5
	7 Hrs.	" "	1.9	0.2	2.8	2.2	7.3
	2 Hrs.	Stable Fly and House Fly	2.5	1.4	1.8	1.2	5.3
3	3 Hrs.	Stabl. & Hs. Fly	1.9	1.1	8.8	4.2	9.5
	4 Hrs.	" " " "	9.3	2.2	5.9	8.2	12.8
	5 Hrs.	" " " "	3.9	4.8	11.8	9.0	17.9
	6 Hrs.	" " " "	10.4	4.9	9.5	10.8	11.0
	7 Hrs.	" " " "	9.4	6.0	13.5	11.8	17.8

*All formulas contained: 0.25% pyrethrins
2.50% pyrethrins
3.00% Methoxychlor

**Equal weights of Freon 11 and 12 used in all but last formula and this utilized 25 percent of Freon 12.

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TABLE 6

Comparison of Effectiveness of Piperonyl Butoxide-Pyrethrins-Methoxychlor vs. Piperonyl Butoxide-Allethrin-Methoxychlor "Cow Bombs" for the Control of Stable Flies and House Flies, Baltimore, Maryland, 1953

			Average No. of Flies/Animal		
Spray Time Per Animal in Seconds	Observation Period	Fly Species	Treated		
			A	H	Untreated
Series 1					
3	1 Hr. after treat.	Stable Fly*	16	19	22
	2 Hrs. " "		9	10	34
	3 Hrs. " "		12	18	35
	4 Hrs. " "		18	18	35
	5 Hrs. " "		21	33	35
	6 Hrs. " "		32	35	29
Series 2					
2	Pre-treatment		98	95	
	1 Hr. after treat.	House Fly**	25	22	
	2 Hrs. " "		29	31	
	3 Hrs. " "		46	48	
	4 Hrs. " "		68	66	

*Counts represent average of treatments made on two consecutive days.

**Counts represent average number of house flies/half animal, alighting over a five minute period.

nearly comparable conditions as it was possible to obtain. All formulas gave excellent protection against horn flies for 6 hours. Even at 12 hours, the treatments provided a 30 to 80 per cent reduction in fly population, with "B," which contained 0.20 per cent pyrethrins, 2.0 per cent piperonyl butoxide, 2.0 per cent Thanite and 3.0 percent methoxychlor, being the most consistently effective. The protection afforded the animals by the different formulations permitted uninterrupted periods of grazing, also a characteristic content-

ment or freedom from worry by flies, two factors that are appreciated by the good dairyman.

Summary and Conclusions

DATA are presented showing the effectiveness of various formulations of piperonyl butoxide in combination with pyrethrins and/or allethrin, and applied to dairy or beef animals for the control of horn flies, stable flies, tabanids and, in some instances, house flies.

Wettable powders containing 10 per cent piperonyl butoxide plus

TABLE 7

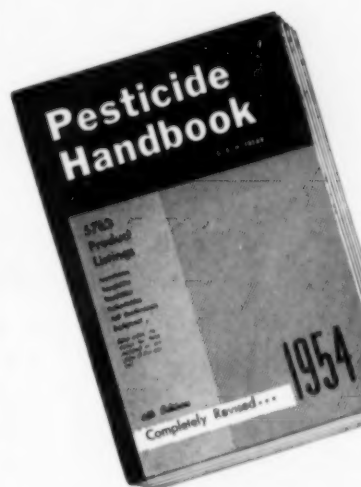
Comparison of Several "Cow Bombs" for the Control of Horn Flies on Dairy Cattle.

Spray Time in Seconds	Observation Period	Average Number of Horn Flies per Animal per Two Consecutive Daily Treatments*								Untreated
		A	B	C	D	E	F	G	H	
2	Pre-treatment	14	4.7	10.7	6.5	7.7	8.5	9.7	8.7	8.0
	1 Hr. after treat.	0.0	0.0	0.0	0.0	0.0	0.0	1.0	2.0	25.0
	2 Hrs. " "	0.25	0.0	0.0	0.75	0.2	1.2	0.25	0.0	34.0
	3 Hrs. " "	0.5	0.0	0.0	0.0	0.0	0.0	0.75	0.0	17.5
	4 Hrs. " "	1.0	0.25	0.0	0.0	0.25	0.0	0.0	0.0	33.5
	5 Hrs. " "	2.25	1.5	3.0	1.5	2.50	1.0	0.5	0.25	24.0
	6 Hrs. " "	0.5	0.0	2.5	4.0	5.50	3.0	0.5	2.2	16.2
	7 Hrs. " "	1.0	1.08	4.25	7.25	4.0	3.5	1.7	0.25	14.0
12	12 Hrs. " "	6.75	3.7	8.7	9.0	2.5	9.5	8.2	6.5	15.5

*Each formula applied to two animals on two consecutive days. See description of formulas under "Materials".

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from 0.75 to 1.0 per cent pyrethrins and diluted at rates of from 20 to 30 pounds/100 gals., when applied to point of run-off, afforded residual protection against moderate and usual numbers of horn flies for 7 to 12 days.

Piperonyl butoxide-pyrethrins emulsion concentrates (10-1) diluted either 1+9 or 1+19 gave excellent protection against horn flies for 5 to 12 days, depending primarily on initial populations. These same combinations when diluted 1+9 provided good protection against rather high populations of stable flies for 1 to 2 days, and from *Tabanus atratus* for 3 days or longer, also with partial protection from each for a few additional days.

When allethrin was substituted for the pyrethrins and piperonyl butoxide was maintained at the same concentrations in both sprays, it required about two times as much allethrin to maintain comparable protection against horn flies, stable flies and horse flies.

Several gas-propelled sprays containing pyrethrins or allethrin in combination with piperonyl butoxide plus methoxychlor, and in some cases "Thanite" or "Lethane," were applied at rates varying from 2 to 6 gms./animal. Good protection was obtained against horn flies for 6 hours after treatment, with noticeable reductions in the visiting populations even up to 12 hours. These same formulas effectively reduced moderate numbers of visiting house flies and stable flies up to 4 hours following treatment of the animals.★★

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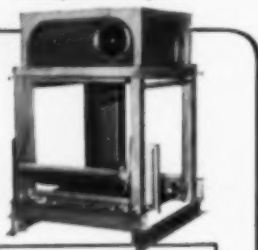
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Tale Ends

To the list of entomologists in the public eye, - famous of course for something other than entomological pursuits - add the name of John Landy, Australian holder of the current record for the mile - something under four minutes. An entomological student at Melbourne University for the past four years, Landy has been pur-

suing butterflies since the age of ten. An article in a recent issue of LIFE credits his powerful leg and lung development to many hours spent in chasing specimens over rough terrain. Out with the butterfly nets, men!

Farmers and county agents can now carry a full organic lab-

oratory in their hip pockets on crop inspection trips. Norwood Technical Institute of London scientists have devised a "vest pocket" laboratory of unusually light weight, which may be used in the determination of the nature and concentration of insecticides to be used in orchards, gardens and farms. The assembly includes 61 components.

James C. Totman, assistant treasurer and manager of Summers Fertilizer Co.'s Bangor, Maine office, was one of the successful candidates in Maine's recent primary election. He was running on the Republican ticket for reelection to his third term in the Maine State Legislature. Jim is also a candidate for Republican Floor Leader in the House.

"Miracle Results" with anhydrous ammonia are publicized in a recent issue of LIFE magazine. The story carried pictures showing nitrogen effects on crops and reviewed production processes.

Gypsy moths, bollworms, maggots and Japanese beetles are among the stars of a new television series scheduled over channel 13 in the eastern states. The first program was given July 12th, conducted by Dr. J. B. Schmitt, associate professor of entomology at Rutgers University. The 13-week series entitled "The Insect, Friend and Foe" is part of Rutgers' observance of the 100th anniversary of professional entomology.

It may be the celebration of the 100th anniversary of entomology that has pushed the subject of insects so prominently into the limelight. Besides appearing on television, they have also hit the headlines in the "small fry" book market. Simon & Schuster, New York publishers, have just brought out a "Golden Book of Insects" in their poster stamp series for kids. Fifty insects are described in this new volume, and lithographed poster stamps of each insect in color are included for the reader to paste into the appropriate section. Most of the insects selected for this volume, incidentally, are of the "non-economic" variety. They run to tumble bugs and cecropia moths rather than boll weevils and corn borers.

Mystery of the month. Who is conducting a survey of readership of publications in the ag chemical field under the name of a previously unheard of "institute"? If they ask us, we can say "not guilty." But we suspect we know where this traces back to, for the address of the "institute" is right next door to a highly respected ag chemical magazine, which incidentally didn't show up too strong in a survey made a year or so ago by an independent organization. Bet they do a lot better in their own survey!

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—Joe McCaughan, Sherard, depends on toxaphene to protect cotton, also uses it to stop worm infestations on wheat and barley.



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—Royce Calhoun, Vienna, says, "Toxaphene lasts longer and does a better job than any dust we've used. In our county, more people are going to toxaphene . . ."



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—Lester Tucker, Jr., Rt. 4, Elkton, uses toxaphene spray to protect his clover from spittlebugs, a serious threat to hay production in many states.



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—T. A. Calloway, Bosco, depends on toxaphene sprays for control of thrips; says "We also obtained excellent results in the use of toxaphene dust to control outbreaks of cutworms on our oats."



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—Marvin McCalman grows cotton in the Red River bottoms near Bradley. "For the last several years," he reports, "I found toxaphene has been very effective in control of overwintering weevils, fleahoppers, and thrips . . ."